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ABSTRACT

This publication provides 80 classroom activities for the teacher. These activities are designed for elementary through high school students and are action-oriented for participation in the school community. Each activity is classified according to appropriate grade level, subject matter, and recycling concept involved. In addition, each activity includes a statement of purpose, a reference to the source of the original activity, and a set of procedures. Some illustrations and sample work sheets are provided. The final section contains resource information on publications, organizations, and films related to recycling and environmental education. (MA)

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Recycling: Activities For the Classroom

ED159075

Selected and Developed by
Mary Lynne Bowman
and
Herbert L. Coon

ERIC/SMEAC CENTER FOR SCIENCE, MATHEMATICS, AND ENVIRONMENTAL EDUCATION.

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SE 024 956

RECYCLING: ACTIVITIES FOR THE CLASSROOM

Selected and Developed by

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ERIC Clearinghouse for Science, Mathematics,
and Environmental Education
The Ohio State University
College of Education and
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1200 Chambers Road, Third Floor
Columbus, Ohio 43212

April 1978

ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for these publications are invited.

John F. Disinger
Associate Director
Environmental Education

Sponsored by the Educational Resources Information Center of the National Institute of Education and The Ohio State University.

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PREFACE

Each year every man, woman and child in the U.S. discards a ton of trash. Nationally, the figures add up to a staggering 400 trillion pounds a year of solid waste--a real disposal problem. Our throw-away society is fast facing a critical long term need for additional raw material and solid waste management.

Recycling is an alternative to the increased use of natural resources for new products and to the reduction of our mounting solid wastes. Each ton of discards we recycle turns an environmental liability into an economic asset.

To adapt the alternative of recycling effectively, it is necessary to turn the concept into a commitment on the part of each of us. Recycling, reuse and extended use must become a part of our daily lives.

The activities included in this publication were selected and developed to give teachers ideas and examples of ways to implement recycling instruction in the classroom. One of the primary objectives of this compilation is to demonstrate that there are now in existence a variety of materials that focus on recycling concerns.

The activities, designed for student use in elementary through high school classes, are "action-oriented" and involve student participation throughout the school community. Each activity has been classified by the authors according to the most appropriate level, subject matter and recycling concept involved. In addition to being classified in these categories, each activity contains (1) a statement of purpose on how the activity may be used, and (2) a reference to a source where the activity may be found in more detail or with variations. (A complete list of all activity references plus additional resource materials including ERIC document numbers for those materials currently available through the ERIC system is found beginning on page 139).

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It is hoped that the teachers who use these materials will recognize that the classified categories and statement of purpose serve only as a guide in selecting appropriate activities and should not be considered a fixed structure. In fact, it is recommended that teachers check for activities in the other grade level sections that may be appropriate for use or to adapt for use for their own particular set of learners.

Mary Lynne Bowman
Herbert L. Coon

April 1978

BASIC CONCEPTS FOR RECYCLING

Modified from Roth, Robert E., et al. Environmental Management Concepts--A List. Technical Report No. 126. Wisconsin Research and Development Center for Cognitive Learning, The University of Wisconsin, Madison, Wisconsin, April, 1970. ED 045 376.

1. Most resources are vulnerable to depletion in quantity, quality, or both.
   Pg. 49, 93

2. The need for recycling is related to a society's attitude toward reusing or extending use of materials.
   Pg. 14, 15, 28, 37, 39, 41, 42, 59, 62

3. The values held by a society determine what are resources and their economic worth.
   Pg. 5, 6, 8, 11, 24, 25, 57, 63, 87, 90, 127, 131

4. Social values and mores influence personal conservation behavior.
   Pg. 35, 68, 83, 91, 98, 116, 134

5. Social, economic, and technological changes alter the interrelationships, importance, and the need to recycle natural resources.
   Pg. 99, 118, 122, 124

6. Resource depletion can be slowed by the development and adoption of recycling methods.
   Pg. 21, 34, 47, 79

7. Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.
   Pg. 3, 7, 16, 34, 53, 69, 73, 74, 75, 78, 80, 100, 101, 110

8. Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radio-active wastes and heat, is important if the well-being of man and the environment is to be preserved.
   Pg. 12, 13, 81, 104

9. Maintaining, improving, and in some cases restoring soil productivity through recycling efforts is important to the welfare of people.
   Pg. 95, 106

10. As populations increase, competition for the use of water increases, resulting in a need for establishing water use priorities.
    Pg. 77

11. Consumption practices are constantly being expanded by our ability to produce and create wants and markets, which affect the rate of resource use.
    Pg. 33

12. Economic efficiency does not always result in conservation of a natural resource.
    Pg. 43, 71, 117, 119, 120

13. Conservation policies are often the result of group action.
    Pg. 48, 89, 133

14. Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.
    Pg. 4, 9, 23, 38, 45, 46, 87, 105, 107, 115, 121, 126

CLASSIFICATION OF RECYCLING ACTIVITIES

Grade Level:	Elementary school	
	Elementary-junior high school	
	Elementary-junior-senior high school	
	Junior high school	
	Junior-senior high school	
	Senior high school	
Subject Area:	Science	including health, nature studies, home economics, etc.
	Mathematics	including arithmetic, geometry, industrial arts, etc.
	Social Studies	including geography, population, history, etc.
	Language Arts	including reading, creative writing, etc.
	Fine Arts	including music, art, theater, etc.

BREAKDOWN OF ACTIVITIES BY CATEGORY

(Some activities fall into more than one subject area.)

	Category	Number of Activities
Grade Level:	Elementary school	18
	Elementary-junior high school	15
	Elementary-junior-senior high school	5
	Junior high school	13
	Junior-senior high school	15
	Senior high school	14
Subject Area:	Science	45
	Mathematics	12
	Social Studies	52
	Language Arts	6
	Fine Arts	15

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Science-Fine Arts	1	
Science-Language Arts	1	
Science-Mathematics-Social Studies	1	
Science-Social Studies-Fine Arts	1	
Fine Arts	2	
Mathematics	1	
Elementary-junior high school		31
Social Studies	1	
Social Studies-Science	3	
Social Studies-Fine Arts	1	
Science	1	
Science-Industrial Arts	1	
Science-Fine Arts	1	
Fine Arts	1	
Mathematics	1	
Mathematics-Social Studies	2	
Mathematics-Science	1	
Science-Mathematics-Social Studies-Fine Arts	1	
Language Arts	1	
Elementary-junior-senior high school		51
Science	1	
Science-Social Studies	1	
Science-Social Studies-Home Economics	1	
Home Economics	2	
Junior high school		65
Social Studies	5	
Social Studies-Science	4	
Science	1	
Science-Industrial Arts	1	
Science-Social Studies-Fine Arts	1	
Social Studies-Mathematics	1	
Junior-senior high school		85
Social Studies	5	
Science-Social Studies	7	
Science	1	
Social Studies-Language Arts	1	
Social Studies-Language Arts-Fine Arts	1	
Senior high school		113
Social Studies	4	
Social Studies-Science	3	
Science	1	
Industrial Arts-Science	1	
Fine Arts	1	
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RECYCLING: ACTIVITIES FOR THE CLASSROOM

ELEMENTARY SCHOOL

PURPOSE: To allow students to observe the amount of waste paper that is generated by a class during a week's time.

LEVEL: Elementary school

SUBJECT: Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: "Paper Waste in Elementary Schools." Environmental Education Section, Alaska State Department of Education, Juneau, Alaska.

ACTIVITY: During this activity the students will collect all the waste material from the class for a week. Obtain large cardboard containers from the custodian for this purpose. Weigh the empty containers. Bathroom scales can be used for this purpose. During the week, collect all waste materials; weigh the containers with the waste paper at the end of the week. Determine the weight of the waste paper by subtracting the empty container weight from the full container weight. Assuming the amount of waste material collected by one class is an average for a normal class, determine the amount of waste material (by weight) that is accumulated by all classes in the school during a week.

What happens to this waste paper? Does the community allow open burning? Should it? How much of the waste paper could be reused in useful ways? (Possible uses are scratch paper, papier-mache materials, fireplace logs made by rolling the paper.) Can paper be recycled to be used again?

PURPOSE: To develop an awareness of recycling versus discarding.

LEVEL: Elementary school

SUBJECT: Social Studies

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

SUGGESTED BY: Jeyne C. Russell, Teacher, St. Michael's School, Worthington, Ohio.

ACTIVITY: Have students prepare a list of the many items used in the home and/or school that are discarded. Suggest paper, for example, to start. Lists should include newspapers, cans, glass bottles and jars, garbage, ashes, etc. Combine lists, discussing each item and possible further use. Using the first three above mentioned, encourage children to involve families by setting up a specific plan of saving said items in the home.

Have students locate recycling stations to which the above may be taken. Stress that papers should be collected in an orderly manner and bundled, that cans and jars should be washed and that colored glass should be separated from the clear.

Discuss immediate possible uses for newspapers in the home and school. They can be used in and for various art projects, a substitute "novelty" wrapping paper, rolled into logs for the fireplace, etc.

A visit to a recycling center would be of interest, followed up by student reports on uses of the recycled "waste" materials.

PURPOSE: To participate in a recycling project to develop teaching aids appropriate for use in your school's kindergarten classroom.

LEVEL: Elementary school

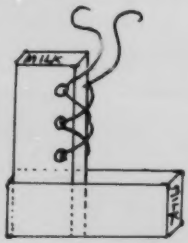
SUBJECT: Social Studies
Fine Arts

CONCEPT: The values held by a society determine what are resources and their economic worth.

ACTIVITY: One way to demonstrate the concept of recycling to your students is to undertake a project in which your class extends the use of common household items normally discarded and has the opportunity to see their finished products put to use by younger children in your school. Free and/or inexpensive teaching aids for kindergarten use can be easily constructed from such items.

For example, egg cartons and shoe boxes can be taped shut and covered with used gift wrappings or contact paper or painted, resulting in attractive lightweight building blocks.

Two used cardboard milk cartons can be constructed into a shoe to help children learn to tie shoe laces. Simply cut a hole in the side of one milk carton large enough to fit the end of the other. Punch holes in the upright container and string with heavy yarn, old shoe strings, etc. to simulate a shoe.



Ask your kindergarten teachers for other ideas for "recycling projects" into appropriate kindergarten teaching aids.

PURPOSE: To recycle used toys and/or games.

LEVEL: Elementary school

SUBJECT: Social Studies
Fine Arts
Industrial Arts

CONCEPT: The values held by a society determine what are resources and their economic worth.

ACTIVITY: Many service agencies collect and repair old toys for underprivileged children. Check with your local service agencies to find out if any in your area provide this service. (The local fire department or newspaper office are good places to start.) Invite someone involved in this type of program to visit your class to inform your students how the project works and show some of their "recycling" efforts. Ask each student to bring a toy or game from home that is no longer used to contribute to the project. You may wish to extend this activity to involve the students in the repair work and/or volunteer to hold a collection drive in your community or school. Posters and flyers advertising your recycling project can be created by the class; designate specific collection areas to student teams; plan a field trip to the agency to deliver your collected items; and set up a time to help the agency distribute the repaired toys and games to their new owners.

PURPOSE: To discover what trash is and how to manage it.

LEVEL: Elementary school

SUBJECT: Science
Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Junglas, Mary. Environmental Learning Experiences for Kindergarten Through Second Grade. Center for the Development of Environmental Curriculum, Willoughby-Eastlake City Schools, Willoughby, Ohio. ED 092 389

ACTIVITY: Collect the trash which accumulates in the classroom after one day. Help the students separate it into three categories: Recyclables, Biodegradables, and Disposables.

Recyclables - Discuss some ways that this material can be reused. Sandwich bags can be used more than one time; cola bottles can be returned to the store; papers of various types can be reprocessed and reused. Find out how Oscar on Sesame Street is using what other people throw away. Learn his song, "I Love Trash."

Biodegradables - These are materials that will decay over a short period of time. In a plot on the school yard, bury some samples of biodegradable trash; unearth this trash periodically to see what is happening. You might also bring some paper, glass, or metal trash at the same time for comparison. Discuss compost piles and organic fertilizers.

Disposables - This is trash that will not decay and cannot be recycled. Is there some recyclable material that could have been substituted for disposable material? For example, using returnable bottles instead of throw-away cans. Discuss the local disposal system. What will happen to this trash?

PURPOSE: To use common vegetables to produce dyes for coloring Easter eggs.

LEVEL: Elementary school

SUBJECT: Social Studies
Science

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Cahill, Connie. Cook's Palace, 130 Worthington Square, Worthington, OH 43085.

ACTIVITY: Discuss with your class that great-"Gramma" needed to be creative if she wanted to color Easter eggs. She couldn't go to the local supermarket and pick up a kit of Easter egg dye materials. She resorted to using food scraps to make beautifully natural dyes.

Foods used in obtaining dyes can be numerous. Here are some examples that produce beautiful dyes.*

Dye Material	Colors Produced
Walnut shells	Subtle buff or adobe
Red cabbage leaves	Beautiful Robin Blue
Orange peels	A light yellow
Carrot tops	Smoky yellow/green
Fresh cranberries	Dark green
Onion skins	Handsome orange
Spinach	Light gold

Experiment with any number of materials and mix the dye liquid to come up with interesting color combinations. Fresh herbs, leaves of flowers, dandelions, beets and berries of all kinds can also be used. It's easiest to have hard-cooked eggs chilled in the refrigerator before you begin.

And now for the how to's:

Take a small amount of a foodstuff and place it in a pan, filled with 2 cups cold water. Bring the water rapidly to a boil, allow to simmer 10 minutes; turn off heat; cover, and steep dye for 30 minutes. Remove food stuff and place dye into containers and refrigerate.

When dye is cold, place hard-cooked eggs into dye. Leaving the eggs in the dye overnight will give the deepest colors. Experiment to see what tints and shades are best.

Remove from the dye and dry on a metal cake rack. Place eggs into the refrigerator promptly after dyeing. Refrigerated hard-cooked eggs can be kept up to 8-10 days.

*Note: Dyes can be kept in the refrigerator for an extended period of time.

PURPOSE: To conduct a litter survey of your neighborhood or school grounds.

LEVEL: Elementary school

SUBJECT: Science

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Schneider, Gerald. Earth Trek . . . Explore Your Environment. U.S. Environmental Protection Agency, Washington, DC, October, 1977.

ACTIVITY: As a class project, do a litter survey of your neighborhood or school grounds. How much of what can you find? Collect the litter (wearing gloves) and place it in paper grocery bags. Because of potential health and sanitation concerns, skip food waste. (It will decompose naturally at a rapid rate). Weigh and count the number of bags filled. How much litter did you get? Does the amount surprise you?

What kinds and how much of each kind of litter did you collect? Divide the litter on the ground into separate piles as follows:

Paper
Metal Cans
Bottles, Jars, and Glass
Plastic
Wood
Other Scrap Materials

Weigh each pile. Which pile weighs the most? Also note which pile takes up the most room. Is the pile that takes up the most room the same pile that weighs the most? If there is a difference, explain the importance of that difference in waste disposal. Is there something you can do to reduce the amount of room needed for any pile of litter?

Which kinds of litter will decay outside exposed to rain and sunlight? Of those kinds, which will decay in a few days? In a few years? In hundreds of years? And which will remain practically forever? What accounts for the differences?

Can all the litter be recycled now? Find out what you can about possibilities (a teacher, librarian, or the sanitation department can help you).

What does your community do with the trash and garbage it collects? Is it put in an open garbage dump or a sanitary landfill? Are there any recycling centers or systems to recover metal and glass wastes? Visit disposal sites and see for yourself.

(P.S. REMEMBER TO REMOVE AND PROPERLY DISPOSE OF ALL COLLECTED LITTER.)

PURPOSE: To grow garbage.

LEVEL: Elementary school

SUBJECT: Science

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Lund, Cherie, and Chanelle Wolfe. Exploration with Garbage. Project ECO-logy. Highline Public Schools, Seattle, WA. Title III, ESEA. ED 132 008

ACTIVITY: Children can collect from garbage, seeds, scrapings and other fruit and vegetable waste. Attractive planters can be made by decorating empty cans, jars, and plastic containers. Seeds should be sprouted in glass containers without soil but with wet paper towels or a damp sponge so children can see the roots forming. The children can plant things in a well-drained soil mixture. They can experiment with the scrapings to see which, if any, will produce growth. Why did some not grow?

Grapefruit, orange, lemon, or tangerine seeds should be planted. They should be in rich soil, kept damp and in good light, but out of direct rays of the sun. Be sure to place at least a half inch of small stones in the bottom of each planter and make drain holes to allow excess water to drain out.

The top of a carrot can be planted in moist sand with only the upper part exposed. This develops into an attractive fernlike plant. With any vegetables, transplanting to an outdoor garden in the spring will be fun and interesting. Pineapple tops can be planted by cutting off the tops (green leaves) with about one inch of the solid fruit portion attached (this is usually the way they are in the garbage). Place the base part in water with the green top exposed. When roots develop, transplant to a pot with soil and cover with a plastic bag for three weeks (the bag will be in the garbage, too). A small cactus-like plant will develop, and in 6 to 12 months tiny pineapples should develop. Avocado seeds should be planted pointed end up, with the tip just above the soil. It will take a month or two before they sprout.

Sweet potatoes, onions, beets, or garlic may be grown by sticking three or four toothpicks around the middle of the vegetable and suspending it in the mouth of a glass jar. Fill the jar with water until the bottom of the vegetable is covered. Keep in a sunny place.

You may wish to transplant seeds later. Remember, an empty egg carton or half-shells of eggs make good planters.

PURPOSE: To investigate biodegradability.

LEVEL: Elementary school

SUBJECT: Science

CONCEPT: Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radioactive wastes and heat, is important if the well-being of man and the environment is to be preserved.

REFERENCE: Our Environment: A Collection of Lessons. Council on the Environment of New York City, 51 Chambers Street, New York, NY 10007. ED 134 415

***ACTIVITY:** Display a piece of glass, aluminum, paper, apple, lettuce and steel. Ask the class to predict which of these substances are capable of rotting or decomposing; i.e., which are biodegradable? Conduct the following experiment to determine whether their predictions were correct:

Dig enough soil from a garden or vacant lot to fill five containers. (One-pound cottage cheese containers would be suitable.) Collect five pieces of each of the substances originally displayed and bury one piece of each substance in each container. Number the containers from 1 to 5. Examine one of the containers each week for the next five weeks. Each time a container's contents are examined, have class keep observations on the condition of each of the five substances. After the last container has been opened, check the original predictions and draw conclusions about which substances are biodegradable.

*Note: Teacher should try this prior to using it in the classroom.

PURPOSE: To investigate what type of toilet tissue breaks up and disappears back into the environment best.

SCIENCE: Elementary school

SUBJECT: Science

CONCEPT: Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radioactive wastes, and heat, is important if the well-being of man and the environment is to be preserved.

REFERENCE: Roller, Lib. Using the School and Community. Nashville Metro Schools Environmental Education Department, Nashville, TN. Title III, ESEA. ED 071 917

ACTIVITY: Obtain as many brands or varieties of toilet tissue as you can. In addition to the types made by various companies and sold in stores, your collection might include types often found in the washrooms of large commercial buildings. Instead of using toilet tissue, a variety of facial tissues or paper towels could be substituted.

Cut or tear two pieces from each type of toilet tissue. Every piece should be approximately the same size. Collect as many wide-mouthed glass jars (of the same size and type) with lids as the number of types of toilet tissue you have. Place a different type of toilet tissue in each jar. Fill each jar half full with water. Tape one piece of tissue to the outside so that you know which type of paper is in the jar.

Put the lids on and shake each jar back and forth in exactly the same way twenty times. Compare the paper inside the jar with the sample taped to the outside.

Allow the jars to rest undisturbed for one week, then shake them again in the same manner and make more comparisons. Why was the size of the jar, the size of the paper, the amount of water, and the number of shakes always kept the same? Which brand of toilet tissue had disappeared the most? Which brand had changed the most? Which brand had changed the least? Which brand would you consider to contribute most to pollution? Why? What does the term "biodegradability" mean?

PURPOSE: To use old newspapers as an energy source by making fireplace logs.

LEVEL: Elementary school

SUBJECT: Science

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

REFERENCE: Jones, Leroy. United States Forest Service.

MATERIALS NEEDED:
Old newspapers
Fine wire or twine
Broomstick or iron rod

ACTIVITY: As a class, hold a newspaper collection drive. To make fireplace logs out of newspapers, you have to roll them as tightly as possible. Use a broomstick or iron rod in the center and roll eight pages at a time. Lay them on the floor lengthwise, roll to about 8" from the end, overlap another eight pages and continue rolling until you have a good sized log. Secure with string or fine wire and slip the broomstick out. Soak the logs in water. (Water will break down the paper's short fibers and keep fly ash from forming.)

Take the logs out of the water and hang with the broomstick or iron rod to pack the paper. Let them dry thoroughly.

This activity could be used as a money-making project for your class.

PURPOSE: To investigate ways to extend the use of cut natural Christmas trees.

LEVEL: Elementary school

SUBJECT: Science
Fine Arts

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

ACTIVITY: Millions of cut natural evergreen trees are purchased each December to help celebrate Christmas. The following ideas are activities to extend the use of a cut tree after the Christmas ornaments are packed away for another year.

1. Prop your tree near your bird feeder to provide extra cover for birds during extra cold months. Most trees will last through January and February in this capacity. Be sure the tree is positioned so that the birds don't become easy prey to cats and other predators.

2. Cut the branches off and use them as mulch for flower beds.

3. The trunk can be cut into logs for use in the fireplace. Caution: Do not burn the branches since needles might be very dry and could ignite quickly, resulting in large flames that could spread outside the hearth. For best results, the trunk logs should be seasoned; i.e. stacked and not used until next fall at which time they will serve as excellent kindling wood.

4. If you live in a climate where temperatures are below freezing in the winter months, you might like to make an ice sculpture in your front lawn. Simply stand your tree in the yard and run a water hose to the base, with the nozzle pointed up from the base. Turn on the water and let the water cover the branches and freeze.

   NOTE: These sculptures make attractive, interesting decorations for school yards.

PURPOSE: To investigate nature's recycling system.

LEVEL: Elementary school

SUBJECT: Science
Language Arts

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Howlett, George, Jr. Project I-C-E: A Supplementary Program for Environmental Education, Science, Grades K through 12. Green Bay, Wisconsin, 1971. ED 055 918

MATERIALS NEEDED: A set of directions (see pp 17-20) for each team of four students

A trowel or digging tool per team

A pencil or writing pad per team

A small plastic bag per team

A ruler per team

A thermometer (optional) per team

Every living thing dies and leaves its remains. Living things produce waste products. Dead bodies and waste products piled up would mean a large pile of garbage in nature. Nature has both plant and animal garbagemen. We call the garbagemen of nature decomposers, because they break down and recycle the garbage.

Nature's garbage contains many good things which must be returned to the soil, or other plants and animals cannot grow. The decomposers help minerals from the garbage go back to the soil. The slowly decaying parts of wood are taken into the soil to hold water and minerals for plant growth. Hole-making animals of the soil help air to go into the roots, and water to sink into the soil when it rains.

Many different animals work together to do the job of cleaning up nature's garbage pile. If there is a lot of garbage and enough water and a warm temperature, you can find many of these animals. We call a group of different animals and plants living and working together a community. Investigate a community of decomposer animals and watch how they work together to recycle the waste. See how they get needed minerals back to where nature can use them again. Find out how decomposer animals are part of a number of communities and the environment around them. See what conditions help communities live. We call the combination of communities and environment an ecosystem.

In class learn about how energy helps living things grow and live. Follow the "food chain" from the sun and its energy to a plant which "produces" sugar, a storage form of energy. Learn how animals eat plants to get the energy of plant sugar. Sugar is made into many kinds of food, both plant and animal. But the energy stored in the food always starts as plant sugar. Some animals eat other animals to get energy.

The last link in energy and food chains are plant and animal wastes including wood and leaves. There is still energy left for animals that can eat up the wastes. List some of the food chains in a nearby woods or field. Figure out what wastes you will find being eaten up by the decomposer animals.

ACTIVITY: Take a field trip to a woods with old trees, stumps, leaves, old logs, stones, and other places where animals are at work recycling nature's waste.

Divide your class into teams of four students each and give each team a set of the aforelisted materials. (p. 16)

Instruct each team to fill out their instruction sheet in a prechosen area as they investigate the decomposers of that area. (You might mark off borders with light string.)

Also instruct the teams to be prepared to PUT BACK most animals that they see, and to collect only one of any kind of animal.

INVESTIGATION HANDOUT SHEET

1. a. Find an old log or stump. Smell it. Feel it. Look at it. Describe how it looks, smells, feels.

_____

_____

b. Guess how much this log or stump is decomposed: (not at all, 1/4, 1/2, 3/4, all decomposed).

c. What parts of the log or stump go back to the soil?

_____

d. Place a small sample of decomposed wood in your bag. Put the rest back in place.

2. a. Look at the log or stump for animals living in it.

b. Watch them. Describe what they do when you watch them.

_____

_____

c. Capture some animals. Look at them in your hand or in the bag. (Centipedes can bite - be careful!)

d. Describe something about different animals you catch. Each team should keep only one animal of each kind. (If you catch a salamander, keep it moist and cool. You can hurt it by holding it in your hands.) Describe color, legs, etc.

1) _____

_____

2) _____

_____

3) _____

_____

4) _____

_____

5) _____

_____

6) _____

_____

e. Measure the size of your animals.

1) _____ 2) _____ 3) _____

4) _____ 5) _____ 6) _____

3. a. Look at old stumps or logs to see the holes going to the animal homes. Take off some bark and see if any hide under it.

b. Look around for evidence of animal homes, tracks, and paths in the stump or log. Describe.

_____

_____

c. Measure the temperature of the inside of an animal home; of the log or stump; of the air outside.

bark temperature _____ air temperature _____

inside temperature _____

4. a. Dig in the old leaves of the forest floor. Smell them. Feel them. Discover how much they are decomposed. Describe their condition.

_____

_____

b. Find a leaf "skeleton." See how the veins remain longer than the rest of the leaf. Take the best leaf skeleton back to the classroom to show others.

5. a. Find the animals which decompose the leaves.

b. Watch them try to hide when you lift their hiding places. How do they react? Describe.

_____

_____

c. Capture some of each kind to observe what they are like. Then let them go. Keep only one animal of each kind. Describe color, legs, protection, eyes, etc.

1) _____

_____

2) _____

_____

3) _____

_____

4) _____

_____

5) _____

_____

6) _____

_____

d. Measure the size of your animals:

1) _____ 2) _____ 3) _____

4) _____ 5) _____ 6) _____

e. Dig into the soil to find any animals under the leaves. Describe them.

1) _____

2) _____

3) _____

f. If you catch a worm, look closely to see how it is made and how it moves. Write two sentences about what a worm is like.

_____

_____

_____

g. Carefully place the thermometer in the soil after you dig a hole (4 inches deep). Put loose soil over it. Wait a few minutes and then read the thermometer. Also read the air temperature.

soil temperature _____ air temperature _____

Upon your return to the classroom, as a group:

A. Determine the number of different kinds of animals found by each group, and add up the total.

Total kinds found by the class _____

B. Use resource center study aids to find out about the life and ways of the various animals.

C. Make drawings of the various animals you have found.

D. As a class, construct a mural of life on the forest floor. Show the different animals and the places they live.

E. Construct a terrarium of old leaves, mosses, decayed wood, and associated animals. Observe it for one week. Do not put too many animals in the terrarium.

F. Discuss the need for man to learn how to recycle his many waste products. At a future date, you may wish to have a unit study on how man handles his "solid wastes." Are there decomposers for man's solid waste?

G. Write a fiction story, poem, news report, or scientific report about the role of decomposers and how they clean up the forest.

PURPOSE: To recycle paper.

LEVEL: Elementary school

SUBJECT: Science
Mathematics
Social Studies

CONCEPT: Resource depletion can be slowed by the development and adoption of recycling methods.

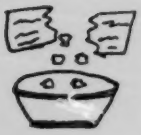
REFERENCE: Recycling instructions reprinted with permission of Environmental Action Coalition, 235 E. 49th Street, New York, NY 10017.

ACTIVITY: Ask your students to speculate how much paper they use in one day (napkins, lunch bags, school work, paper cups, newspaper, etc.). What would life be like without all of these products? At this time there are enough trees to make all of these paper products, but we might not always have an abundant supply of trees. Used paper products can be made into usable paper. This is called recycling.

Recycle your own paper.

Materials needed:

- bucket or large bowl
- egg beater
- newspaper
- piece of window screen about 4 inches square
- instant starch (this is not necessary, but it will make the paper stronger)
- two or three used pieces of paper



Tear the paper into very small pieces. Put the small pieces in the bowl.

Fill the bowl with water, It is best to use warm water, if possible. If you want to use the starch, add two teaspoons of it to the water now.

Let the paper soak in the water for at least 10 minutes. Then beat it with the egg beater until it becomes soft and mushy. This is called "pulp."

Dip the screen into the bowl carefully, tilting it so the edge goes in first. Then lift the screen up flat, letting the pulp cover the screen.

Let the water drip back into the bowl.

Turn the screen upside down on the newspaper. This has to be done carefully so the pulp doesn't all come apart.

Slowly and carefully take off the screen. Don't move the pulp! The pulp should stay on the newspaper.

Leave the pulp on the newspaper until it dries. When it is dry, you will have recycled paper!

Slowly take the recycled paper off the newspaper.

Of course, your recycled paper is much thicker and rougher than recycled paper made in a paper mill. It doesn't look like the recycled paper made commercially. This is because paper mills have all kinds of machines to make the paper smooth and flat.

PURPOSE: To increase student awareness of litter and how it affects our environment.

LEVEL: Elementary school

SUBJECT: Science
Social Studies
Fine Arts

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Environmental Exchange: A Beginning. President's Environmental Merit Awards Program, U.S. Environmental Protection Agency, and Dow Chemical Company. Copyright 1971.*

MATERIALS NEEDED: Cotton, rag, piece of string, paper, peanut butter sandwich, aluminum pie tin, pliers.

ACTIVITY: Ask the children to keep an eye open for litter on their way home and to give a report to the class the next day. Teacher can check a suggested location to see if it warrants showing the whole class. If so, walk the class there and pick up all the litter on the way and at the spot. Put it in a garbage bag. Point out how nice the spot looks now.

In the classroom, examine collection and list kinds of litter. How did it get there? What can the children do to keep an area clean? What can they suggest that others can do? Have each child look in his or her desk and around the room.

Draw pictures of area before and after cleanup. Write a poem or story to go along with the picture. Maybe the class would like to volunteer to keep a certain section of the playground clean.

Burn a cotton rag, piece of string, a piece of paper and peanut butter sandwich over an aluminum pie tin. Hold with a pair of pliers. Keep children at a safe distance. Is the smell pleasant? Have the children noticed anyone burning anything in their neighborhood? Does it look or smell good?

Have the children list or tell you about the kinds of solid waste. Who causes it? What can be done?

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PURPOSE: To collect natural materials and create "recycled art" projects.

LEVEL: Elementary school

SUBJECT: Fine Arts

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Kohuth, Barbara J. and Boyd T. Marsh. An Educational Guide for Planning an Improved Human Environment. Hudson, Ohio: Inner Circle Press, Inc., 1974. ED 141 081

ACTIVITY: Extending the use of an object or product is considered to be a form of recycling. A recycling focus or theme can be implemented by creating a variety of art forms from natural objects commonly found in the environment.

Following are some examples of possible "recycled art" projects:

1. Dry, press, and mount flowers along with wood, straw, and stone ("the naturals").

2. Large flat stones may be decorated with ecological signs or polished and combined into "stone sculpture" with other rocks and pebbles.

3. Hold a "Sculpture Session" using wet sand, snow, or mud.

4. Create "original" animals from pine cones, nuts, berries, dried weeds, etc. This project can be extended to include the animal's ability to adapt to its environment by asking each student to (1) name his created animal, (2) describe its intended environment and food habits, and (3) explain how he created his animal so that adaptation is possible. Ex: Long tongue to catch insects.

PURPOSE: To investigate ways to use garbage.

LEVEL: Elementary school

SUBJECT: Fine Arts

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Lund, Cherie, and Chanelle Wolfe. Exploration with Garbage. Project ECO-logy. Highline Public Schools, Seattle, WA. Title III, ESEA. ED 132 008

ACTIVITY: Ask students to bring from home yesterday's garbage.

Following is a list of some activities and art ideas that you can do with garbage. Your activities will depend upon what types of garbage you have. You and your class may think of different activities. Be sure to stress health and safety.

ACTIVITIES AND PROJECTS WITH GARBAGE

1. Put aside and clean and dry all bones. Try to reconstruct the animal using glue.

2. Mosaics and collages can be made from chips of egg shells, dried coffee grounds, or dried fruit peelings.

3. Egg cartons can be used for making caterpillars (remember to paint them a bright color!), trains, flowers, or anything else within the imagination of the group.

4. Using wasted paper towels from the lavatory or newspaper, one can make papier-mache. If light globes are in your garbage, they make excellent maracas after being papier-mached and broken.

5. If teacher wishes to explore the area of compost, garbage may be buried and dug up at a later date.

6. There are a variety of musical instruments that can be made from garbage:

   a. coffee can bongos
   b. can lid cymbals (make certain sharp edges are covered with tape)
   c. musical bottles (put different amounts of water into bottles--hit with mallet to produce different sounds).

7. Many exciting, creative things can be made from milk cartons of all sizes. (Before starting, wash and dry cartons thoroughly.)

   Cut any size milk carton to desired height. Cover the outside with cloth scraps--felt, velveteen, printed cottons are easy to handle. Just overlap and glue. Self-adhesive papers work very well, come in attractive patterns and wipe clean.

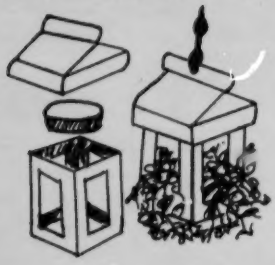
   What will it be? A pencil holder, a button box, a litter box for the car? Maybe a cachepot for your favorite plant. Turn a carton upside down, cover it

with matching wallpaper scraps, and it's a spray can cover for all those aerosols in the kitchen, bath, and laundry.

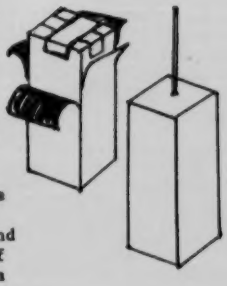
Make a box--a sewing box, a jewelry box, a box for recipes or photographs.

8. Hanging Planter

Cut the top from a half-gallon carton. Cut each corner down 1" from the top and bend back. Cut openings in four sides. For the roof, cut the gable from a gallon carton 3/4" from the gable line. Fit the two pieces together snugly and glue. Use plastic cup for the plant container. Your planter is ready to hang or use as an attractive table decoration.

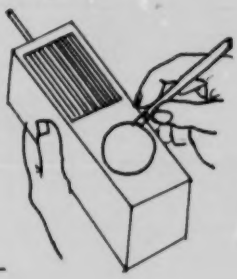


9. A Walkie-Talkie That Really Works



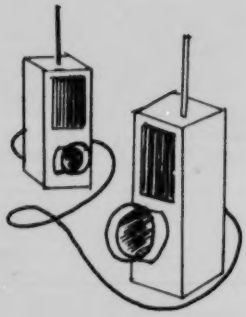
Cut the gables off two quart milk cartons. Cut two square pieces from a third carton to fit the opening and make a flat top for each carton. Seal on four sides with pressure-sensitive tape. Paint or cover with self-sticking paper.

Cut five slits 2½" long, 1/8" wide and ½" apart. Start 1" from top of carton. This is where the sound comes out. Cut the bottoms out of two small drinking cups, leaving a ½" edge. These are the mouthpieces. Cut two circles near the bottom of the carton just large enough to hold the cups, leaving about 3/4" of the cup outside the carton.



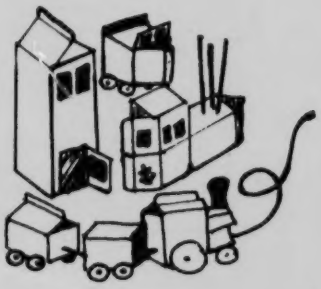
Tie a knot in one end of a long, long string. Punch a small hole in the back of one carton opposite the mouthpiece just big enough for the string to slide through. Pull the string from the inside to the outside until it reaches the knotted end. Punch the same size hole in the other carton and thread the string from the outside to the inside. Tie a knot in the second end; pull string backwards until it is stopped by the knot.

Insert one cup in each circular hole until it fits snugly. Insert a straw in the top of each carton for an antenna. The string should be slightly taut when sending and receiving.



10. Half-Pint Project

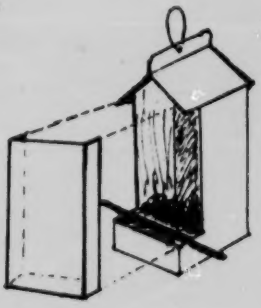
Build a village, boats, trucks or a train from half-pint, 10-oz., pint and quart cartons. Straws make good axles and derricks. Use spools, buttons or milk carton circles for wheels. Just cut openings for windows and doors. Spray with bright colored plastic paints. A cord, knotted at one end and strung through the cars of the train, will keep this pull toy "on the track."



11. Feed the Birds

Children will love to see birds come again and again to this easy-to-make feeder.

A half-gallon carton is a comfortable size. Cut opposite sides of the carton back 1½" from the bottom. Trim under the gable to make the roof overhang. Milk cartons don't leak, so punch holes in the bottom to let any rain water drain out. A plastic straw or dowel makes a good perch. Punch a hole in the top and hang from a branch or eave or nail directly to a tree or post.



Fill the bottom with bird seed and watch the fun.

PURPOSE: To explain the concept of recycling and help young students grasp the idea of 100 objects and graphing via number stories.

LEVEL: Elementary school

SUBJECT: Mathematics

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

SUGGESTED BY: Carol Cotter, 2nd Grade Teacher, St. Michael's School, Worthington, Ohio

MATERIALS NEEDED: Large graph to record number of cans brought in by various students. (A thermometer type works well.)

ACTIVITY: Discuss with the class the need for conserving our natural resources. Discuss what cans are made of and where this material comes from. Discuss whether the earth may run out of these materials. Lead the class toward the idea that they might help by recycling beverage cans. Explain the idea of recycling.

Ask the children to bring rinsed-out beverage cans to class. As they bring them in, have the children fill in the appropriate number of spaces on the graph. Use the graph each day as a basis for practice with number stories.

Examples: John brought in 12 cans and Mark brought in 6. How many cans all together? How many more cans did John bring in than Mark did? How many cans were brought in on Monday? Who brought in the most cans? If Jenny brought in 8 cans on Monday and 4 cans on Tuesday, how many cans did Jenny bring in all together?

Follow-up Activities: The following ideas are ways to recycle the collected cans into useful items:

1. Containers - Cover or paint and decorate to hold pencils, mail and "stuff." Cover with material, decorate with braid, ball fringe, or natural objects like pine cones, burrs, acorns, and so forth.

2. Stilts - Use large juice cans. Decorate with latex paint, wallpaper, contact paper, wool, felt. Punch holes in either side of can near top edge. Run heavy twine or cord through can and tie to desired length; step on can, pull cord tight to hold cans on and walk.

3. Doorstops or Bookends - Use coffee cans or others with plastic tops. Fill cans with sand, cover with plastic tops. Decorate with felt, paint, braid, or other material.

4. Lanterns - Fill cans with water and freeze; ice will prevent cans from bending when you punch holes. Make

design by punching holes with nails of varying sizes. Design should be drawn on first. Glue or screw on a bottle cap in bottom of can to hold candle. Add wire if lantern is to be hung.

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RECYCLING: ACTIVITIES FOR THE CLASSROOM

ELEMENTARY-JUNIOR HIGH SCHOOL

PURPOSE: To show the amount of material wasted in excess packaging.

LEVEL: Elementary-junior high school

SUBJECT: Social Studies

CONCEPT: Consumption practices are constantly being expanded by our ability to produce and create wants and markets, which affect the rate of resource use.

REFERENCE: Land Abuse - Quality Control. Environmental Science Study Curriculum, P.S. Jones Junior High School, Washington, DC 27887.

ACTIVITY: If possible, take the class or a committee of students to a grocery store and have the students find examples of various types of excess packaging and try to explain the purpose of such packaging. If a field trip to the store is not possible, the teacher and students could bring various packing examples to class.

Things to notice about the packaging include:

1. What are the purposes of packaging items? Which purposes are essential (e.g., protect item, prevent spoilage) and which are non-essential (e.g., attractive colors, make item look larger)?

2. Does the color of the package make any difference? Did you ever buy a product because you liked the way it was packaged?

3. How is the packaging of an item used in advertising the item, especially television advertisements?

4. Are all items packaged? Some items won't spoil and are easy to handle without packaging; examples are spools of thread, pens, screwdrivers, hammers, etc. Yet sometimes these items are also found in "bubble packs." What are the advantages of "bubble packs?"

5. Some items are packaged in small containers for convenience. Compare the amount of cardboard packaging in a variety pack of cereal with a single large box of cereal that holds the same amount. Open each variety pack and measure the total area of cardboard used in the single box. Which was less expensive? What are the advantages and disadvantages of the "variety pack?"

PURPOSE: To examine the importance of being a "garbologist."

LEVEL: Elementary-junior high school

SUBJECT: Social Studies
Science

CONCEPT: Resource depletion can be slowed by the development and adoption of recycling methods.

REFERENCE: "The Importance of Being a Garbologist"--a ten-page booklet published by GRIP (Group for Recycling in Pennsylvania), P.O. Box 7391, Pittsburgh, PA 15213. 1-10 copies, 15 cents each; 11-25 copies, 20 cents each; 26 or more copies, 10 cents each.

ACTIVITY: Secure copies of the booklet for several or all class members. Use the materials found in the booklet as a teaching resource for a small unit on recycling substances typically found in America's garbage cans.

Major headings in the booklet are:

- How to be a garbologist
- Important facts to know about garbology
- Everything in nature is recycled
- Projects for you to do
- Crafts from trash
- Start a compost pile in your own yard or at school
- Hidden word puzzle.

The booklet is written in easy-to-read style. Several of the projects suggested can be done by individuals, groups, or by an entire class.

PURPOSE: To explore the concept of "waste," its uses, misuses and abuses.

LEVEL: Elementary-junior high school

SUBJECT: Social Studies
Science

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: Uhas, Doreen. Columbus City Schools, Columbus, Ohio. Junior High School teacher.

ACTIVITY: By touring the neighborhood, especially on garbage collection day, or by bringing in a day's worth of kitchen garbage in a clear plastic bag, students can try to answer questions as to why someone threw away what they did. Is there anything that might have been used again in another way? How much of it might not have been thrown away in another home or country? Do certain factors such as age, economic level, or ethnic origin enter into a disparity of more waste or less waste? What, in general, does a collection of garbage tell about our lifestyles and tastes?

Can students imagine what might be included if, for example, we examined a bag of garbage from a home in China? From California? From a farm? What do they think is the "best" way to dispose of garbage? Why? Why do we use many ways that aren't the best?

PURPOSE: To understand how compost can be made and to appreciate the potential of composting as a garbage disposal and soil-enriching process.

LEVEL: Elementary-junior high school

SUBJECT: Science
Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

ACTIVITY: After some exploratory discussion on the value of composting, invite an agricultural specialist, avid organic gardener, or similar knowledgeable person to come to the class and discuss his experiences with compost making and to respond to student questions. Ask him to furnish each class member with a handout or bulletin on building compost piles.

Secure permission and support from the school administration to build a compost pile of appropriate size on the school site and have the class compost some of the materials now disposed of in other ways.

Use the compost to fertilize flower beds, shrubs, and other plantings on the school grounds.

Urge children, if feasible, to involve parents in a similar project at home.

PURPOSE: To investigate ways clothing can be recycled.

LEVEL: Elementary-junior high school

SUBJECT: Social Studies
Fine Arts

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

ACTIVITY: "Recycled" clothing is a current youth fad that is also economically practical. It is popular with today's youth to have their everyday clothes look "lived in" rather than new. Army surplus stores that sell used clothing inexpensively are frequented to purchase "in" school clothes. Long pants that have become too short or are worn at the knees are cut off and the legs raveled to make shorts. Creative patches and appliques are added to pants and shirts as a decorative way to cover worn spots and tears. Point out to your class that the idea of recycling clothes is not really new with this generation--although it may be more popular with the teenagers. Hand-me-down clothes have been a part of the American culture since the first settlers arrived. The waste-not-want-not philosophy carried through to many conservation activities in everyday lives. Salvable material from worn clothing was cut into patches to make quilts, skirts and shirts. In the first half of the twentieth century, feed for farm animals was packaged and sold in brightly printed cloth bags. Many youngsters during that era wore pajamas, skirts, shirts, and aprons made from recycled feed bags. Have your students interview their parents and grandparents for other recycling efforts in former generations.

As a class activity, your students might enjoy collecting scrap material from home and making a wall-hanging "quilt" depicting highlights of their school year. Scenes can be appliqued on a large piece of heavy material with leftover yarn. (As a time saver, appliques could be pasted on the background material.)

PURPOSE: To observe directly the different kinds of waste created in students' own school environment. Students will think of ways to solve some of these problems.

LEVEL: Elementary-junior high school

SUBJECT: Science

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

ACTIVITY: Collect the waste baskets in your room or in several rooms (for any time period). Have the students divide the contents into groups of similar material. Let the students devise their own classification system.

Suggestions for classification systems:

Younger children:	colors, shapes, sizes, smells, hardness, softness.
Others:	plastics, metals, paper, organic, inorganic, biodegradable, non-biodegradable, renewable resource, nonrenewable resource.

A chart may be developed collectively or individually. Following the sorting, the following questions might be appropriate:

What is a waste basket?
What is waste?
How much waste is here?
How many hours or days of waste are here?
Where will it all go?
What can we do to cut down on waste?
How can we use some of this waste right now?
(Build a sculpture, reuse scrap paper, make collages, make flower planters out of plastic containers and cans.)

Additional follow-up activities:

Trace the manufacture of one or more of the things thrown away. Example: How paper or plastic is made.

Put up a chart so students can record types of waste they can reuse at home and new ideas for reusing waste at school.

Do some experiments using aquariums. Fill one with soil, one with water, and one with air. Put in some of the waste. Observe what happens. How many days does it take to change? Describe it. Add some water to all aquariums then add soil--repeat the above questions.

Take a trip to the school incinerator --what happens here? How often is it used? What kind of anti-pollution filter is used?

Write to a manufacturer of plastics, cans, paper, or other material to find out what they are doing to recycle or reuse their product.

PURPOSE: To make bird feeders by extending the use of commonly discarded materials.

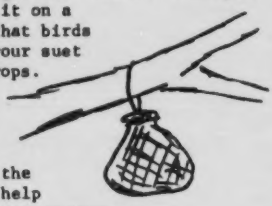
LEVEL: Elementary-junior high school

SUBJECT: Science
Industrial Arts

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

ACTIVITY:

1. Empty net onion or potato sacks make excellent holders for suet to aid in attracting winter birds. Just put the suet in the bag and tie it on a branch. You should notice that birds will increase their use of your suet feeder as the temperature drops. This is due to their high metabolism, which requires them to eat as much as 2½ times their weight in food per day. The suet provides the birds with necessary fat to help them through extremely cold temperatures.



2. Empty, washed plastic bleach bottles can be used to hold wild bird seed. Cut a hole in one side of the bottle, leaving about 1½" of the bottom. Bottles can either be hung from a branch or nailed to a tree, post, etc. Fill the bottom with seed and become a bird-watcher!

3. Peanut butter bird feeders can be made from coat hangers. Simply mold the peanut butter to the hanger. As an extra treat for the birds, take handfuls of wild bird seed and mix with the peanut butter.

4. An attractive and effective suet and peanut-butter feeder can be made from a 3-inch to 5-inch section of log 1½ to 2 feet long with the bark still on it. Holes drilled in the side can be filled with suet or peanut butter. Suspended at one end from a tree limb or clothes line the log will attract woodpeckers, brown creepers, and chickadees.

5. A simple suet feeder can be made by attaching a wire soap dish face down to a piece of board. By nailing two staples to one side, an effective hinge can be made. Place the suet in the soap dish and close it like a book. A bent nail placed in the side opposite the staples acts as a lock. Place the board on a tree or post, and you are in business.

6. One type of inexpensive feeder consists of a wooden box with one side removed. The back of the box is fastened to a tree or post 4 or 5 feet above the ground. A strip of wood 2 to 3 inches wide nailed across the lower edge of the open side keeps the feed from being spilled. Tar paper placed over the top of the box makes a waterproof roof. A window-sill feeder may even be easier to construct. It is basically an extension of the window sill that is used as a shelf on which to place the food. A railing or curb around the edge will keep the food in a tray. The basic plan can be elaborated upon, limited only by the materials and ingenuity available.

PURPOSE: To extend the use of old hiking boots or other heavy shoes to make planters.

LEVEL: Elementary-junior high school

SUBJECT: Science
Fine Arts

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

REFERENCE: Environmental Learning Forum. An undergraduate student organization in the School of Natural Resources, The Ohio State University.

ACTIVITY: Pictured is the logo designed by the undergraduate student organization named above as a reference for Earth Week activities in 1978. The idea for the logo design originated from a student activity that involved taking old hiking boots, lining them with Saran Wrap, filling them with potting soil and planting hemlocks in the boots. Expand on this idea with your students to bring in an old sturdy shoe and follow the above procedure, selecting any household plant. You might like to start your plants from seeds (such as marigold, zinnia, etc.) and transplant the seedlings into the shoes. Bulbs such as tulip and hyacinth can be used if they are placed in the freezer for a couple of weeks before planting them in the shoe.

PURPOSE: To explore examples that illustrate how specific products might be reused rather than discarded.

LEVEL: Elementary-junior high school

SUBJECT: Fine Arts

CONCEPT: The need for recycling is related to society's attitude toward reusing or extending use of materials.

REFERENCE: Kohuth, Barbara J. and Boyd T. Marsh. An Educational Guide for Planning an Improved Human Environment. Hudson, Ohio: Inner Circle Press, Inc., 1974. ED 141 081

ACTIVITY: Using the following chart, ask each student to conduct a home survey and cite examples of "new uses" for "old products.'

HOUSEHOLD RUMMAGE "RECYCLING"			
PRODUCT	OLD USE	NEW USE	ENVIRONMENTAL BENEFIT
1. Cracked coffee mug	Beverage container	Pencil holder	No solid waste
2.			
3.			
4.			
5.			
6.			
7.			

"Hints from Heloise" King Features 235 E. 45th St., New York, NY 10017, is a good source of ideas for this activity.

With the help of class mothers, students might enjoy conducting a "Rummage Fair" or sale, with their creations on display.

PURPOSE: To conduct a newspaper recycling survey.

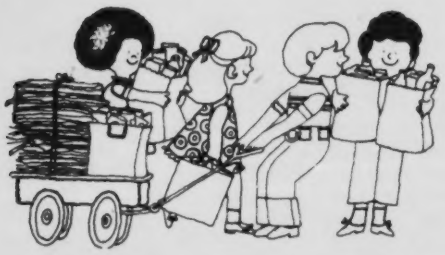
LEVEL: Elementary-junior high school

SUBJECT: Mathematics

CONCEPT: Economic efficiency does not always result in conservation of a natural resource.

REFERENCE: "Recycling," from an Ecology Reprint, Ranger Rick's Nature Magazine. Single copy available free from Educational Servicing, National Wildlife Federation, 1412 16th St., NW, Washington, DC 20036.

ACTIVITY:



It might be interesting to see how much newsprint your family uses. Here's one way to find out: Collect the newspapers your family received in the last 7 days. Weigh them. Divide the weight by seven to get average weight of an issue. If you can't find all seven days, you might call the newspaper office and ask the approximate weight of an average week's newspapers.

About how much would one year's papers delivered to your house weigh? . . . . . _____

Call the local used newspaper dealer and find out how much he is paying for old papers. . . . . $_____

If your family sold all its newspapers for a year, how much recycled return would you receive? . . . . . $_____

If all the students in your class received the same newspaper and saved them for a year, how much recycled return would you get? . . . . . $_____

If everyone in your school got the same paper--they probably don't--how much return could you get in a year? . . . . . $_____

Call up the newspaper and ask how many copies of the paper are printed in one year. (If you called them about average weight, you can ask this question at the same time.) If all of these used papers were resold, how much recycled return would there be? . . . . . $_____

If your school saved newspapers for one year and sold them for recycling, what could you use the money for? A tree for the front of the school?

Keep in mind that not all the money you would get back from old newspapers would be profit. You would have to deduct travel expenses in collecting the papers and cost of getting them to the dealer.

PURPOSE: To become more aware of the amount of metal and glass thrown away by American families.

LEVEL: Elementary-junior high school

SUBJECT: Mathematics
Social Studies

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Schatz, Albert and Vivian Schatz. Teaching Science with Garbage. Emmaus, Pennsylvania: Rodale Press, Inc., 1971. ED 073 904

ACTIVITY: Ask each pupil to involve his entire family in saving all cans and disposable bottles used during a two-week period. Cans should be washed to eliminate food source for flies or other insects.

At the end of the two-week period, each pupil should bring to the class data regarding the number and weight of aluminum cans, tin cans, and throwaway glass bottles.

Organize data from the entire class into a large matrix on the chalkboard and involve children in calculating total amounts of various materials thrown away, amounts per family, amounts per person. Speculate on how much is thrown away by all families with children in the school; by all families in the city.

Should we be concerned with this problem? Why, or why not? What can they or their families do about it? What, if anything, might or should the government do?

PURPOSE: To explore the possibility of establishing a recycling collection center on school grounds.

LEVEL: Elementary-junior high school

SUBJECT: Social Studies
Mathematics

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

Paper drives are often used by a school or by a class group to raise money for specific activities such as a camping trip. Frequently the projects are quite successful.

The accumulation of waste paper, particularly newsprint, is an endless process in many homes. Hence the occasional paper drive is an inadequate solution to the problem of getting paper routinely into the recycling stream. Aluminum cans, which require enormous amounts of electrical energy to make, are also easily collected and sold. Glass containers are considerably more difficult to handle, and probably should not be collected and handled by children in a school collection center.

As neighborhood centers, elementary and/or junior high schools might serve as logical sites for collecting newspapers and aluminum cans. Under adult supervision students could do most of the physical work involved in bundling and tying the paper and in compacting the aluminum cans. With careful organization no student would spend excessive amounts of time on this project, which would serve as a money raising effort while it contributes toward the saving of natural resources and energy.

ACTIVITY: Discuss with classes at the sixth or seventh grade level the idea of establishing and maintaining a collection center on the school grounds. Would students be willing to do the physical labor involved? Could a place be found to store the collected materials safely? Is a market for waste paper and aluminum guaranteed? How can necessary transportation be secured? What do parents think about the idea? What does the school's administration think? Could/should the PTA be involved somehow?

If a positive response from all parties concerned can be secured, develop and operate the collection center for at least six months. Then evaluate the operation to determine if it should be continued indefinitely.

PURPOSE: To become aware of the enormous energy used in the United States to produce "throw-away" glass containers.

LEVEL: Elementary-junior high school

SUBJECT: Mathematics
Science

CONCEPT: Resource depletion can be slowed by the development and adoption of recycling methods.

ACTIVITY: Ask students to save for one week all "throw-away" glass containers that normally go into their trash or garbage cans at home. Ask that they weigh the collection and report the weight to the class. From the sample of responses have students calculate the total weight of glass thrown away by all of the families represented in the class during a week, a month, and a year.

Secure from a glass manufacturing company an estimate of the number of cubic feet of natural gas needed to produce a ton of glass bottles. Have students calculate the cubic feet of gas used to produce the thrown-away bottles per week, month, year. Compare the amount used to produce a month's supply of throw-aways with the amount used to heat an average home (or better still, their own, if gas is used) per month.

Should we reduce our use of throw-away bottles to save energy? Why? Why not? Who would be hurt? Who would be helped? What, if anything, do students plan to do about this matter?

PURPOSE: To start an aluminum recycling program.

LEVEL: Elementary-junior high school

SUBJECT: Science
Mathematics
Social Studies
Fine Arts

CONCEPT: Conservation policies are often the result of group action.

REFERENCE: Our Environment: A Collection of Lessons. Council on the Environment of New York City, 51 Chambers Street, New York, New York 10007. ED 134 415

ACTIVITY: Hold up several aluminum cans and ask the class--what should I do with these empty cans? Do they have to become garbage? Discuss that garbage has to be put somewhere and we are running out of places to dump it. Since each person produces about five pounds of garbage per day we could someday all have to live on garbage dumps. One way to help our environment is to reuse or recycle products rather than toss them away as useless. Aluminum is worth money (10¢ a pound) when it is recycled. Since there is only a limited supply of aluminum ore in the earth, collecting aluminum cans for recycling is one way students can share in helping the environment.

To start an aluminum recycling program:

1. Ask permission to start an aluminum recycling program from the school administrator.

2. Solicit the aid of the custodial staff to help find a place to store the aluminum.

3. Ask the Parent Association or other teachers if they would help run the program and help transport the aluminum to a recycling center. (Recycling centers can usually be located by checking the yellow pages and calling local aluminum companies. Other sources include local junk yards, dumps, citizen groups and city manager's office.)

4. Publicize the school recycling center with posters placed around the school and flyers sent to the parents.

5. Explain to students how to recognize an aluminum can as follows:

   a. Most are marked "all aluminum."
   b. They are lightweight.
   c. They have rounded bottoms.
   d. They have no side seams.
   e. A magnet will not stick to the side of the can.

6. Store aluminum cans, trays, and foil in large garbage bags. (If students crush the cans with their feet, more cans can be kept in each bag.)

PURPOSE: To obtain the pertinent information regarding a recycling project from a news story.

LEVEL: Elementary-junior high school

SUBJECT: Language Arts

CONCEPT: Most resources are vulnerable to depletion in quantity, quality, or both.

REFERENCE: Vagts, Christopher and Irma Schwartz. Man--The Problem Solver. The Aluminum Association, Inc., 750 Third Avenue, New York, NY 10017.

ACTIVITY: Current newspaper stories tell of efforts that science, industry, and government are making to help combat resource depletion.

Give each student the following news story:

NEWS STORY

The State of Connecticut has selected contractors to build the first two of eight solid waste recovery plants. They will convert the state's residential, agricultural and industrial solid wastes into fuel and reusable materials.

The Connecticut Resources Recovery Authority, which will manage the system, selected Combustion Equipment Associates, Inc., and Garrett Research and Development Co., Inc., to design and build and operate facilities in Berlin and Bridgeport, Conn., respectively.

Each plant will collect, recover and convert both its own solid wastes and those of its neighboring towns. Together, by mid-1976, they will begin processing 3,600 tons of municipal solid waste daily.

The state's $295 million plan--the first of its kind in the nation--calls for the creation of eight regional collection and recovery centers, which will reduce air and water pollution and will replace the present fragmented system of local landfill operations and incinerators.

Aluminum will play a key role in the operation of this pioneering energy recovery system. At a typical value of $300 per ton, aluminum is by far the most valuable material found in quantity in municipal waste on a per pound basis.

Studies carried out by the Aluminum Association and other organizations suggest that revenues generated by reclaiming the aluminum fraction of solid waste can be a determining factor in making total waste recycling economically feasible.

Now, ask each student to answer all of the following questions:

QUESTIONS:

1. (a) Write a headline of not more than six words for the news story.

_____ _____ _____

_____ _____ _____

(b) Now try to write a headline in three words.

_____ _____ _____

2. In the first paragraphs of a news story the questions, Who, What, Where and When, are usually answered. Answer these questions as you can from this story's first two paragraphs.

Who _____

What _____

Where _____

3. Name as many ways as you can in which the proposed plant would conserve vital resources.

_____

_____

_____

_____

_____

4. What steps have to be taken <u>after</u> the meeting described in the story before the plan is in operation?

_____

_____

_____

5. Why is aluminum important to the operation of this plant?

_____

_____

_____

RECYCLING: ACTIVITIES FOR THE CLASSROOM

ELEMENTARY-JUNIOR-SENIOR HIGH SCHOOL

PURPOSE: To conduct an experiment demonstrating the rate of decomposition of various materials by observing mold gardens.

LEVEL: Elementary-junior-senior high school

SUBJECT: Science

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Schatz, Albert and Vivian Schatz. Teaching Science with Garbage. Emmaus, Pennsylvania: Rodale Press, Inc., 1971. ED 073 904

Earthworms help us get rid of garbage. But microbes are more important helpers. Under favorable conditions, an earthworm consumes an amount of food equal to the weight of its body each day. A microbe can digest its weight in food in a matter of seconds.

In a large quantity of decaying or composting garbage, there are many more microbes than earthworms. The total weight of microbes is greater than the total weight of earthworms. Microbes also decompose many more things than earthworms do. They even break down and digest certain chemical substances which earthworms find indigestible or poisonous.

Some of the food earthworms eat consists of living and dead microbes. Microbes in turn feed on dead earthworms. This is an example of what scientists call the "balance of nature."

Earthworms are easily seen because of their size. People usually think that microscopes are needed to see microbes. That is true for some microbes, but not for all of them. You can see certain large microbes. Some microbes are plants. Others are animals. Bacterial, yeasts, and molds are plant microbes. Protozoa are animal microbes.

Flowers, fruits, vegetables, shrubs, trees, and other plants need water, minerals, and in some cases additional nutrients as well. Those are provided by the soil in which the plants grow.

Plant microbes also need water and food for their development. Many things that make up our garbage serve as food for different kinds of microbes. That is why milk sours, meat rots, cheese gets moldy, cider gets hard, and eggs develop the typical "rotten egg" odor.

Just as there are flower, vegetable, and herb gardens, so we can have mold gardens.

ACTIVITY: To set up a mold garden, you need a round metal can or plastic jar six to eight inches in diameter and three or four inches deep. If you cannot locate a round container, use one that is square or rectangular.

Add enough soil, preferably loam, from your garden or from under shrubbery until you have a firmly-packed layer about one inch deep. This should be moist but not water-logged.

Now you are ready to supply food for the molds to grow on. For this purpose, select things that you would ordinarily consider kitchen refuse and discard as garbage.

You can use nut shells, potato peels, banana skins, old cereal, stale bread, an apple core, orange skin, a paper

napkin, etc., etc. Do not include protein materials such as cheese, meat, or gelatin because these may cause unpleasant odors.

What you want are small pieces no bigger than a half inch square and about one-eighth to one-quarter inch thick. Place five of these on the surface of the soil in your can or plastic container as shown in the diagram.

Inside view of a mold garden in a can. Peanut shells, paper napkins or other items normally discarded as garbage are placed on a firmly packed layer of soil taken from under shrubbery.

Now cover the container with a thin sheet of clear, transparent plastic, held in place with a rubber band.

The plastic cover prevents drying out and also provides a window through which you can see what happens. Within two or three days, some of the garbage items will begin to get moldy. That is the start of your mold garden.

It may be advantageous to remove the plastic cover for a few minutes every three or four days. That will help maintain a good supply of oxygen which many molds need. You can also add a little water if the soil seems to be drying out.

The molds that develop may be white, black, green, red, orange, pink, yellow, purple, blue, or gray. Any color is possible. Your garden may have molds of different colors, sizes, and shapes growing at the same time. Or there may be sequential changes when some molds replace others.

The completed mold garden. Within two or three days, growth should appear on the refuse items in the container.

Each mold is really a colony consisting of millions of cells of one particular species. Except for the white, cottony growths, the colors of molds are usually due to spores. These are comparable to the seeds of higher plants. The dry, dull powdery appearance of the surface of most mold colonies is due to millions of spores. These spores blow around and start new mold colonies, just as air-borne seeds of higher plants propogate their species.

Bacteria, protozoa, yeasts, and other microbes are also present in your mold garden. But molds are easier to see because their colonies are large and colorful.

The molds that grow in your garden are the same kinds that develop on jellies, jams, ham, bread, and other foods. Molds are classified as fungi. Some molds are stages in the life cycle of mushrooms, toadstools, and shelf or bracket fungi which grow on trees.

It may seem strange to you that a mold in your mold garden may develop into a mushroom that comes up on your lawn after a rain. For a long time, people thought that molds and mushrooms were different organisms. They certainly look different. But in many cases, they are merely two stages in the life cycle of the same organism.

You may also be interested in setting up a mold garden with small pieces of rubber, cellophane, plastic, leather, brown paper, corrugated carton, paraffined milk container, etc., etc.

Mold gardens show you which molds attack different materials. They also tell how rapidly various things decompose. Keep a record of which materials disintegrate most quickly, and which go to pieces most slowly. Is there any difference between cellophane and plastic in this respect?

Within a week or two, the molds in your garden may begin to disappear. Small nematode worms may then be seen. These

animals feast on the bacteria which grew on the molds, and on the molds themselves. One form of life thus replaces another as the food supply changes. For all these molds, bacteria, and nematodes, the soil is "home."

What you observe in your mold garden is what happens in well-aerated garbage compost. Microbes, earthworms, and other forms of life digest and oxidize garbage, and ultimately their own bodies as well. The end-product is the good rich humus that is largely responsible for the fertility of soils.

PURPOSE: To learn a variety of uses for tree bark.

LEVEL: Elementary-junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Russell, J. Almus. "Bark!" Woodburning Quarterly and Home Energy Digest, v2, n4, Spring, 1978.

ACTIVITY: Most barks are important for many reasons. They may be used for plant mulch, soil conditioners, sewage recycling, and animal litter. They furnish forest foods, beverages, flavorings, and medicines. In time of deep snows they even provide emergency rations for game and hunter alike. Many dyes of many colors have bark origins.

The following uses (activities) for bark are from the above article listed as a reference:

"SEWAGE RECYCLING. A new method of sewage recycling relies upon the use of hardwood barks--the refuse from sawmills. The bark is ground into tiny pellets, the size of grains of sugar, then mixed with ground garbage and raw sewage. The mixture is heated to 120 degrees Fahrenheit to kill the bacteria and eliminate the odor. After winter weathering and decomposition, the fertilizer can be spread on plowed land and worn-out fields. Although the bark is deficient in nitrogen, the sewage is high in that element and water. The blend is additionally fortified by the rich minerals found in human and kitchen waste. Small towns that cannot afford sewage disposal plants might well consider this type of waste recycling."

Check with local sewage disposal plants or with your town council to see if bark has ever been considered as a method of sewage recycling.

"SOIL CONDITIONERS. Gardeners find that sandy, clay, or silted soils are loosened by mixing them with powdered barks. This procedure improves tilling, structure, and aeration. It also increases water penetration and absorption, and provides erosion control. In addition, the treated bark is free from weeds and seeds."

Have gardeners in your area considered this procedure?

"MULCH. Today, bark mulch is often laid on the open banks of new highway construction--both to hold the soil and to aid in seed germination. Nature's coverings last longer than straw, are less fire hazardous, and do not lose volume through dryness.

"Commercial firms add compost, ammonia, and fertilizer pellets, particularly if the bark is ground. Thus treated, such mulch is free from weeds and seeds. It also reflects less heat from its surface to the under sides of plants and seeded ground.

"In addition, sheets of bark may be laid between garden rows to retain ground moisture or placed on top of the sawdust banked in winter around the sides of houses and barns."

Ask your students to look for bark near highway construction.

Perhaps your class would like to try bark tea and/or dyeing with bark.

"FOOD. The inner barks (cambium) of the white pine, slippery elm, and beech all have food value. When pounded, ground, and mixed with fish oil or fish broth, they make a forest-iron ration.

"The cambium of many birches is also sweet and sustaining--a life saver for many starving people. It may be eaten raw, chopped into bits, or cut in spaghetti-like lengths for addition to soups and stews. It may also be dried for storage or carrying.

"A flour prepared from the inner bark of the slippery elm by drying and grinding it, then mixing it with milk, is known to provide a nutritious and wholesome food for infants and invalids.

"A pleasant woodland tea may be prepared by beating an egg with a teaspoon of the same bark. Boiling milk is poured over the mixture before it is sweetened to taste."

"DYES. After our foremothers had spun and carded the woolen yarns, they dyed them for beauty and attractiveness. Naturally, they turned to forest barks for the colors desired.

"Barks commonly used were the alder for bluish-black; apple for yellow; black birch for reddish-brown; butternut for orange or yellow; hemlock for tan; horse chestnut for yellow; red maple for dark blue; red oak for red; white oak for tan; sassafras for pinkish-brown; soft maple for purplish-black; and sumac for gray.

"Home-produced mordants set the colors: copperas (caustic); vinegar (acid); strong tea or hemlock bark (tannin); and soft soap plus rusty nails (iron oxide). Alum, soda, and salt are present day mordants."

PURPOSE: To recycle fats and make your own soap.

LEVEL: Elementary-junior-senior high school

SUBJECT: Science
Social Studies
Home Economics

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

REFERENCE: Schatz, Albert and Vivian Schatz. Teaching Science with Garbage. Emmaus, Pennsylvania: Rodale Press, Inc. 1971. ED 073 904

In our highly technological civilization, food, clothing, shelter, and even education, recreation, and cultural facilities are provided more in terms of social rather than individual production. In other words, families are no longer self-sufficient units. Instead, people must depend upon one another. This is what we call specialization or division of labor. Each of us does one job, and usually spends full time at it.

This way of life is efficient and therefore desirable because it has made possible our high standard of living. But at the same time it is unfortunate that it tends to lead us away from the world of nature and from the simpler ways of doing things which were part of the everyday life of our forefathers. Perhaps the currently popular "do-it-yourself" movement is, in part, a reflection of the desire to maintain some cultural continuity with that previous era when people routinely and, as a matter of course, "did it themselves."

"What has all this got to do with soap?" you may wonder. Well, soapmaking, you see, used to be one of those "do-it-yourself" jobs. There was just no place to buy soap. So, people had to make it themselves if they wanted it. Nowadays, though, few of us even know how it's done. But it's a simple process that can be lots of fun, especially for youngsters.

ACTIVITY: Save your kitchen grease and fats from meat trimmings and other sources. Vegetable oils can be added to them. Tallow, which is beef and mutton or sheep fat, and lard, which is the fat from pork and bacon, make the best kind of soap. Therefore, it is advisable to mix poultry fats and vegetable oils with lard and tallow rather than use them alone. First, you must clean the fat by boiling one part fat in one or two parts of water. When it is boiling, stir for a while and then strain the upper layer of fat through two or three thicknesses of cheesecloth to remove suspended particles.

After this is done, dissolve a thirteen ounce can of ordinary household lye (which can be purchased at almost any grocery or hardware store) in two and a half pints of cold water. If you are in a hard water area, use rain water so as to avoid the calcium and magnesium which make water hard. These minerals will prevent you from getting a good product. The lye should be added slowly, a little at a time, while you stir the water with a wooden stick. Use an enamel pot or an iron container, because lye corrodes aluminum. Be careful not to get any onto your clothes, skin or eyes. (If you accidentally do, neutralize it with diluted vinegar and then wash with water.) Once lye is completely dissolved, allow the solution to cool to room temperature.

Now you're ready to actually make the soap. Melt six pounds of your clean fat. This is equivalent to thirteen cupfuls.

Get it to a temperature where it just feels warm to the skin on the back of your hand. This should also be done in an enamel pot or an iron container. Then stir the fat with a wooden stick (you can use the same one with which you made up the lye solution) while you pour in the lye. Do this mixing very slowly. Pour a little and stir, then wait before adding more lye. This step is very important. It should take at least ten and preferably twenty minutes. Be sure to pour the lye into the fat, and not the other way around.

Continue your slow stirring for another thirty minutes or an hour. At this stage, let the kids come in and lend a helping hand with the stirring so they can participate in "Operation: soap-making." During this additional stirring period after all the lye solution has been added, the soap mixture will gradually become thicker and more viscous. When it reaches this condition, it is ready to be poured into molds where it can set and solidify. Cardboard boxes or cigar boxes are usually suitable for this purpose. After you have filled these molds with your soap slurry, set them in a warm place without moving for about one week. When they have hardened, you can peel away the cardboard and cut your soap into cakes of convenient size.

Now you've "done it yourself." This is what people used to have to do if they wanted soap. There were no supermarkets in those days. They "did it themselves" just as you've done it.

For those who are chemically-minded, the following information may be of interest. Fats belong to the the group of organic compounds known as esters. Each fat consists of glycerine, which is a kind of alcohol, plus so-called fatty acids. A fatty acid is an organic acid and is quite different from a fat, which is an ester. Lye is sodium hydroxide, otherwise known as caustic alkali. That's why you must handle lye carefully to prevent spilling, splashing, and spattering. Therefore, when you make soap, don't let the children mix the lye, but have them enter the picture only at the final stirring stage.

When you combine the lye and fat, a chemical reaction occurs. This reaction has the technical name of saponification. What happens is that the lye separates the fat into its two components, glycerine and the fatty acids. The sodium in the lye then combines with the fatty acids to form sodium salts of these fatty acids. These sodium salts are what you want. They are the soap.

Now, how does hard water interfere? Well, hard water contains a lot of calcium and magnesium. And when these minerals are present, they form calcium and magnesium salts of the fatty acids instead of sodium salts. You see, the sodium salts (or sodium soap) is soluble and so forms good suds. But calcium and magnesium soaps are insoluble, and therefore do not form suds. To sum it all up, soap-making is nothing more than a process for converting insoluble fats into water-soluble detergents. We use lye because it accomplishes just this.

These different reactions which occur can be written this way:

Fat → Glycerine + Fatty acids

Fatty acids + Lye → Sodium salts of fatty acids (Soap)

Soap + Hard water → Insoluble calcium and magnesium salts of fatty acids (No soap)

PURPOSE: To use leftover popped popcorn and kernels to make flour and milk.

LEVEL: Elementary-junior-senior high school

SUBJECT: Home Economics

CONCEPT: The need for recycling is related to a society's attitude toward reusing or extending use of materials.

REFERENCE: Goulart, Frances Sheridan. "'Waste-watcher' Primer", Wood Burning Quarterly and Home Energy Digest, v2, n4, Spring, 1978.

ACTIVITY: Your class might enjoy trying the following recipes for Popcorn Flour and Popcorn Milk taken from the article listed above as reference.

Popcorn Flour

Grind the seasoned or unseasoned popped kernels in an electric blender until they are meal-like or reduced to a floury fineness. Refrigerate in plastic sacks and use to replace part of the flour or meal in any bread--especially cornbread, cake or pancake recipes.

Popcorn Milk

Soak the popped and unpopped kernels overnight in milk. Next day, grind the mixture to extract as much flavor as possible, then pour through a strainer. The resultant milk imparts a rich, salty, buttery, corny flavor to biscuits, corncakes, or crepes, and is especially memorable as a substitute for water in your next pot of rice.

PURPOSE: To recycle fruit rinds and seeds.

LEVEL: Elementary-junior-senior high school

SUBJECT: Home Economics

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Goulart, Frances Sheridan. "'Waste-watcher' Primer", Wood Burning Quarterly and Home Energy Digest, v2, n4, Spring, 1978.

ACTIVITY: Taken from the article listed above are some unique ideas for recycling fruit rinds and seeds that you might like to try with your class:

1. Grapefruit rinds are super salvage if you have slugs outside your kitchen door. Set the rinds up like little yellow igloos wherever the enemy makes its slimy presence felt and the citrus condominiums will deslug your garden for up to 3 days.

2. Would you welcome a non-chemical odor-eater in your kitchen or a 100% natural shine on your shoes? Orange or tangerine peels toasted in a 350 degree oven will effectively deodorize a room, while plain orange juice (too sour to consume) will desmudge a pair of dark leather shoes.

3. You can use banana peels to fend off tarnish on your tea trays or flop-fever amongst your philodendrons. Put the peels through a meat grinder and the resultant juices will restore silver to its former splendor. Or simply use the innerside of the peel to massage grime away. Then heap the peels someplace in a very warm room and when thoroughly dried (i.e., black and wizened up) crumple to a powder and store. Reconstitute with a bit of water and use as you would any liquid fertilizer whenever your houseplants need a bit of nutritional fortification--organic and 100% free.

4. Reaching further into the fruit basket, here is a parsimony you can practice with seeds normally thrown away. Papaya seeds properly dried and pulverized in your blender make an exotic gourmet pepper.

5. Although you can't squeeze blood from a turnip you can extract a honey substitute from cantaloupe seeds. Just combine seeds and the attached pulp with equal amounts of water, blend till liquified, strain and use as a sweetener or low calorie drink.

6. Many fruits and vegetables have seeds that can be used for planting and growing more food. Most of the seeds would have to be washed thoroughly and dried before using. Most county extension agents have pamphlets or free material on growing specific vegetables. (Look in your telephone book under county offices, Cooperative Extension Service.)

RECYCLING: ACTIVITIES FOR THE CLASSROOM

JUNIOR HIGH SCHOOL

PURPOSE: To discover how "waste" materials are made useful.

LEVEL: Junior high school

SUBJECT: Social Studies

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: A Supplementary Program for Environmental Education--Social Studies. Project I-C-E, 1927 Main Street, Green Bay, WI 54301, 1971. Title III, ESEA. ED 055 917

ACTIVITY: This is a study of how items that were once considered to be waste materials are now products in demand. The activities should be generated by the class through the teacher's guidance.

As the class winds up a project and begins to dispose of the material gathered for the project, begin a discussion on what happens to waste material and how it can become a useful material again.

While discarding waste paper, begin a discussion of paper recycling. Visit a print shop and a recycling center. Try to determine how much paper is thrown away in a day in your class, in your school. Calculate this in terms of dollars and cents. How much does it "cost" to recycle paper?

The study of sawdust is a fun unit. Sawdust was once a waste product but is now in demand for sweeping compounds, particle board, paper manufacture, and other products. A trip to a sawmill might be of interest here.

PURPOSE: To examine the idea of providing regular pick-up service to collect recyclable materials.

LEVEL: Junior high school

SUBJECT: Social Studies

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: "Solid Waste Management Newsletter," vII, nl, January 1978. Cooperative Extension Service, Cook College, Rutgers--The State University of New Jersey, New Brunswick 08903.

ACTIVITY: Share with the class the following news item found in the reference cited above.

"SOURCE SEPARATION SERVICES: The Young-Guenther Co., Inc. (Y-G) reports that they have been collecting over 260 tons of paper monthly from 6 New Jersey communities with a population of 129,000 and over a 100 tons of glass monthly from 3 communities with a population of 79,000 by supplying a door to door collection service on a weekly basis. The company pays the town for the material they collect, and the town does not have to dispose of these materials in their regular waste disposal stream. In 1978 Y-G will begin collecting ferrous metal in West Orange. They also hope to eventually collect aluminum from those communities desiring this service."

Engage the class in discussing the feasibility of such a collection service in their community. What equipment and facilities would be required? What manpower?

Assign to a small group of students the task of investigating the market for waste paper, glass, aluminum and iron in their community. Do the buyers of these substances forsee a steady or highly irregular market?

Finally, discuss the idea that the school might organize (with parental help) some type of "waste watcher group" to collect waste paper and other materials as a money-making venture. What problems would arise? Would students be paid? Could year-around service be guaranteed? Who would object? Is the need for such service really important?

PURPOSE: To investigate solutions for a problem in your community.

LEVEL: Junior high school

SUBJECT: Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Vagts, Christopher and Irma Schwartz. Man - The Problem Solver. The Aluminum Association Inc., 750 Third Avenue, New York, NY 10017.

ACTIVITY: Give your students the following information to demonstrate one solution to an environmental problem:

"Aluminum was first made available in abundance at economical prices in the early years of this century. Today over 5,000,000 tons are produced each year to be used in countless ways in our everyday life. The many uses of this lightweight metal make it truly the metal of our modern world.

"Naturally, with a metal that is this widely used in products, some of these are discarded to become part of our solid waste each year. Aluminum lasts so well, that actually less than 1% of all solid waste is, in fact, aluminum. But with 400 trillion pounds of solid waste and garbage each year, the disposal problem is a real one that has not yet been solved in the United States.

"The aluminum industry has led the way toward a solution--for after aluminum products have served their purpose and been discarded, they can be collected, melted, and reused. This is called recycling.

"More than 20% of the aluminum used today was once in some other manufactured form. And that percentage could grow with more people getting interested in the recycling idea.

"Here is how recycling works: collected soda cans, for example, are brought to one of the hundreds of aluminum reclamation centers or to independent scrap dealers who pay for them according to weight. Then this scrap is shredded, put together in large bundles and sent off to aluminum producers. At the producer the metal is melted and ready to be used in thousands of ways.

"Everyone benefits from the recycling of aluminum. The collecting group, like the scouts or a school team, earns money for its own use or for community service. The landscape is made more attractive by eliminating litter. There is less solid waste to be disposed of, and therefore, less pollution of the environment. And--a valuable natural resource has been conserved by reusing it in products that man wants and needs. Recycling of aluminum saves 95 percent of the energy that would be needed to make new metal from ore.

"Clearly, the recycling of aluminum is one solution to many of today's problems."

Now ask your students to think of a problem in your community and possible solutions. The following work sheet might serve as a guide:

Your Part

The story of recycling above shows how one industry is working on today's problems. You can play a part too, by getting something started with a community problem you know.

I. Name one unsolved problem that concerns you.

II. What has been done toward finding solutions for that problem in your community? Elsewhere? (The librarian or daily paper can help.)

III. From what you have learned and thought about, what seems to be a good way to solve the problem?

PURPOSE: To survey student attitudes toward purchasing recycled paper.

LEVEL: Junior high school

SUBJECT: Social Studies

CONCEPT: Economic efficiency does not always result in conservation of a natural resource.

REFERENCE: Schneider, Gerald. Earth Trek . . . Explore Your Environment. U.S. Environmental Protection Agency, Washington, DC, October, 1977, and Recycled Paper Products, National Association of Secondary Material Industries, Inc., 330 Madison Ave., New York, NY 10017.

ACTIVITY: Pose the following question (taken from Earth Trek . . . Explore Your Environment, listed above as a reference) to your class:

What Would You Do?

You want to buy some recycled writing paper. A store near you has the recycled paper next to regular writing paper. The recycled paper costs more than the regular paper. Which do you buy?

Solicit each student's response.

Now, make available to each student the following information reprinted from Recycled Paper Products (listed above as reference).

Conserving Natural Resources

"Everyone wants a better environment. But it remains for each one of us to make the commitment that can make it possible. Recycling is the environmental commitment in terms of conserving natural resources as well as reducing solid waste.

"Paper recycling is the alternative to the increased use of trees...trees which, in spite of improved growing and harvesting techniques, can no longer be counted on to meet the spiraling paper and lumber demands of our soaring economy. There have been repeated warnings about our forest limitations in the face of an annual paper production that will soon be 50% above present levels.

"Paper recycling conserves hundreds of millions of trees every year, stretching our timber reserves. It enables us to move from use-and-discard to use-and-reuse. It doubles and redoubles the mileage we get from our wood resources.

"In addition, the U.S. Environmental Protection Agency reports that recycling requires less energy than virgin material production and results in less air and water pollution.

"There certainly are many pluses--economic and environmental--to paper recycling."

Economic Value

"Recycling waste paper can add hundreds of millions of dollars to our national economy--and reduce our solid waste costs by a like amount. Each additional ton of waste paper we recycle turns an environmental liability into an economic asset. We presently do not recycle 48 million tons of paper each year.

"It has been estimated that about 35 million tons of that amount could be recycled. And if we don't recycle more, the problem will get worse: in a few years there will be almost 50% more waste to contend with.

"It all depends on economics. Waste paper will be recovered for recycling, instead of dumped or burned, only when there is a paper mill customer for it. Therefore, as the consumer demand for recycled paper products grows, so will the economic value of waste paper presently being discarded grow.

"Paper stock processors also are seeking to expand opportunities for exporting recycled materials surplus to our domestic needs. "Have not" nations abroad represent growing markets for recycled paper, and that gives the U.S. a valuable asset in terms of increasing exports and improving our international trade positions.

"Paper recycling seems like an almost miraculous rebirth of valuable raw materials and products. The potential of recycling is limited only by our own willingness to give recycled paper more economic value through consumer preference."

After students have read and discussed this information, ask each again the "What Would You Do?" question. Did responses change as a result of new information? Point out the problems associated with making the American public recycling-conscious. How would your students go about changing attitudes of the general public?

PURPOSE: To overview problems associated with recycling.

LEVEL: Junior high school

SUBJECT: Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: "Recycling and the Consumer." Publication 117.1/1974, issued by the U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, Washington, DC 20460.

ACTIVITY: Secure from the reference source cited above several copies of the colorful chart. Assign to different students in the class the responsibility to read and report orally on various sections of the chart, entitled (1) What is Recycled; (2) What is Not Recycled; (3) Efforts to Recycle Household Wastes; (4) Barriers to Recycling; (5) Encouraging Trends; (6) Approaches to Municipal Recycling; and (7) What the Consumer Can Do.

Follow the reports with total class discussion on the status of recycling efforts visible in the community. How feasible is it to expect school age children to do anything about this problem?

PURPOSE: To overview the importance of recycling.

LEVEL: Junior high school

SUBJECT: Social Studies
Science

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures and ecological principles.

REFERENCE: The Aluminum Association, 818 Connecticut Avenue, NW, Washington, DC 20006.

ACTIVITY: Secure from the reference source cited above a free copy of the color sound filmstrip "Recycling--An Ecology Study." Secure also up to 35 free copies of the eight-page brochure entitled "Litter, Solid Waste and Recycling."

Use the filmstrip and the brochure as an introductory visual and reading experience prior to a class discussion on the importance of recycling solid waste materials, particularly energy intensive products such as aluminum cans.

In view of the fact that used all-aluminum cans have a cash value of one-half to three-fourth cents each, explore with the class the possibility of getting the class or the school involved in a plan to collect and sell such cans as a money raising project. Review the idea with the school's administration . If approved, ask the administration to assist in working with parent groups such as PTA to elicit their cooperation.

PURPOSE: To compare the cycles of a recycling-conscious economy and the natural recycling process.

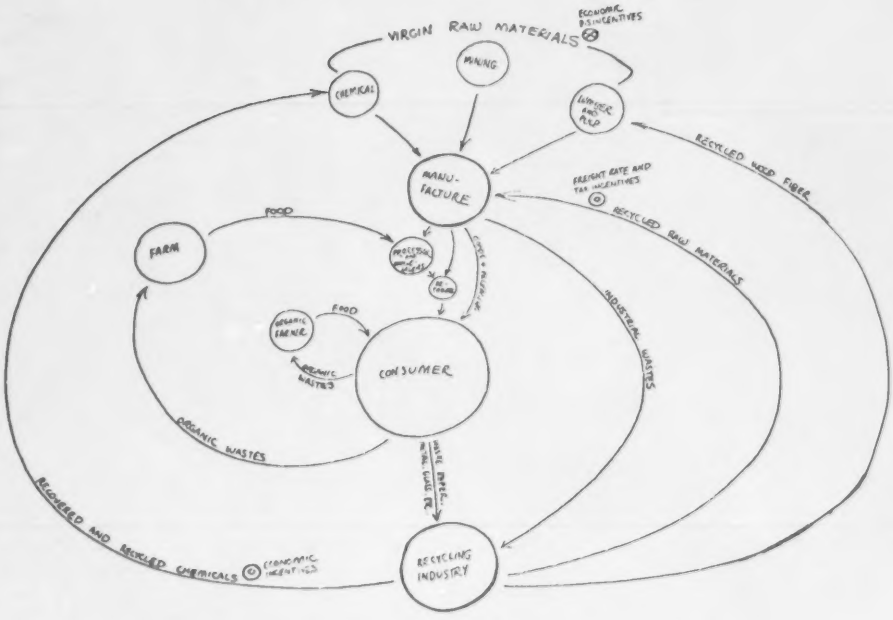
LEVEL: Junior high school

SUBJECT: Science
Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: "Recycling (Special Issue)". Rodale's Environment Action Bulletin, v5, n1, January 5, 1974, p. 7. Emmaus, Pennsylvania: Rodale Press, Inc.

The Movement of Goods In a Recycling-Conscious Economy, Circa 1976



This chart shows the circular paths taken by goods and materials in an economy in which recycled materials are extensively used.

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Economic incentives should be focused on the line from Recycling Industry to Manufacture entitled "Recycled Raw Materials." Disincentives should be applied in the three industrial segments at the top, "Chemical," "Mining," and "Lumber and Pulp."

All of these movements are served by transportation, primarily rail and truck. Rates for recycled materials leaving"Recycling Industry"and flowing elsewhere should be cut. Rates for transporting materials from the "Virgin Raw Materials" segment should be hiked.

Food should move as directly to the consumer as possible, and all organic wastes should be returned to farmland--either to the growing number of small organic farmers or to the growers whose products go to processors and retailers.

The packaging industry inserts itself at the processing level, where all goods from manufacture of most farm products go to be packaged. Packaging can be held to a minimum by regulating these middlemen that cluster between the manufacturer and the consumer.

Not shown is the sewage cycle, which is implied by the lines bringing food to the consumer and organic wastes back to the farm. Sewage should be recycled along these lines. Industrial effluents that carry dangerous substances such as heavy metals should be treated at the manufacturing level and "Industrial Wastes" go back to the recycler to be processed into usable chemicals or raw materials for manufacture. Paper returns to the pulp mills to be processed and sold to manufacturers again.

ACTIVITY: With your class, construct a chart depicting a natural food cycle. Your chart should include energy source, abiotic materials, producers, primary and secondary consumers, and decomposers.

Expand on your "natural recycling chart" by illustrating specific examples in different ecosystems; i.e., forest, pond and meadow.

Discuss the similarities between the Recycling-Conscious Economy chart and the various ecosystems' components.

PURPOSE: To examine water recycling in the community.

LEVEL: Junior high school

SUBJECT: Science
Social Studies

CONCEPT: As populations increase, competition for the use of water increases, resulting in a need for establishing water use priorities.

Enormous amounts of water are used in business and industry for cooling and washing. Food processing plants, breweries, steel manufacturing, electric generating plants, automatic car washes, and many other examples can be identified. The quality of water needed for different purposes varies greatly. Water used for final stage operations in a food cannery ought to be as pure as the community's drinking water supply. The quality of water required in the first stages of an automatic car wash can be a mixture of fairly dirty water and detergent. Obviously the water needed to cool the rollers in a steel rolling mill need not be of the same quality as the drinking water in the factory.

Some persons have suggested that it is foolish to expect cities to produce expensive pure drinking water for uses that can be accomplished by lower quality water. They urge that business and industry do more to develop systems to recycle a larger portion of the water they use and thus reduce the need to constantly enlarge municipal water systems.

ACTIVITY: Involve the class in identifying some very large water users in the community. Ask students in groups of two or three to contact responsible administrators of these business, commercial, or industrial establishments to ascertain what, if anything, they are doing to recycle the water they use. If they are not doing this now, do they see it as a likelihood in the future? Why or why not? What advantages and disadvantages do they see in a move toward more recycling of water?

Ask each group to report what it has found to the class and, if possible, record or videotape the reports for use in other classes. Engage the classes in discussion-reaction to the findings reported by students.

PURPOSE: To investigate the use of plastic for household items and the environmental problems associated with discarding plastic materials.

LEVEL: Junior high school

SUBJECT: Science
Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Schatz, Albert and Vivian Schatz. Teaching Science with Garbage. Emmaus, Pennsylvania: Rodale Press, Inc. 1971. ED 073 904

ACTIVITY: Save all the plastic your family discards in a one or two week period.

Calculate the average weight of plastic that each member of your family discards in a year. At that rate, what is the total weight of plastic that is discarded by all the people in your community in a year?

What particular problems are encountered in disposing of plastic by composting it or burying it in a landfill area?

Burn three or four small, thin pieces of different kinds of plastic. Do you think that incineration is a good way of getting rid of used plastic? Why?

What do you think can be done about the plastic pollution problem?

List all the things you use that are made of plastic.

How many of these items do you really need? Would you be willing to do without them?

For which items could you use other things not made of plastic?

PURPOSE: To investigate ways people can help nature to recycle natural resources.

LEVEL: Junior high school

SUBJECT: Science

CONCEPT: Resource depletion can be slowed by the development and adoption of recycling methods.

REFERENCE: Kohuth, Barbara J. and Boyd T. Marsh. An Educational Guide for Planning an Improved Human Environment. Hudson, Ohio: Inner Circle Press, Inc., 1974. ED 141 081

ACTIVITY: Nature recycles natural resources to a limited degree; growing population's use of resources exceeds nature's recycling capacity. Thus society must assist in recycling processes to maintain the availability of resources.

As a class, fill out the following chart by (1) listing a resource; (2) reviewing the natural recycling processes for that particular resource; and (3) naming processes people can employ to recycle that resource.

PEOPLE HELPING NATURE TO RECYCLE RESOURCES		
Resource	Natural Recycling Processes	People-Induced Recycling Processes
Water	Water Cycle	-Aeration -Filtration -Waste water treatment
Land	Food Chain/Cycle	-Planting legumes to replace nitrogen in soil -Crop rotation -Addition of fertilizer

PURPOSE: To investigate a "car graveyard" to learn what parts of junked cars are recyclable.

LEVEL: Junior high school

SUBJECT: Science
Industrial Arts

CONCEPT: Individual citizens should be stimulated to become well informed about recycling development, problems, management procedures, and ecological principles.

REFERENCE: Kohuth, Barbara J. and Boyd T. Marsh. An Educational Guide for Planning an Improved Human Environment. Hudson, Ohio: Inner Circle Press, Inc., 1974. ED 141 081

ACTIVITY: With your class, visit a car graveyard or junkyard. Conduct an interview with a junk dealer to find out what parts or materials from junked cars are recycled. For example, car batteries and mufflers are sometimes recycled. What is the process? Recycled tires are being used for underwater reefs and playground swings. Are there other uses? Brainstorm as a group to suggest other parts of old cars that might be recycled. Chose a few of the suggestions and investigate what problems might be involved in putting your suggestions into operation. What would be the relative costs? Benefits?

PURPOSE: To learn about solid waste problems and your community, and how it responds to these problems.

LEVEL: Junior high school

SUBJECT: Science
Social Studies
Fine Arts

CONCEPT: Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radioactive wastes and heat, is important if the well-being of man and the environment is to be preserved.

REFERENCE: Schneider, Gerald. Earth Trek . . . Explore Your Environment. U.S. Environmental Protection Agency, Washington, DC , October 1977.

"Each year, Americans "throw away" 7.6 million television sets, 7 million cars and trucks, 48 billion cans, 26 billion bottles and jars, and 30 million tons of paper! Waste disposal now costs $4.5 billion per year. Something has to be done with all this trash and garbage, even if it is not the best thing that can be done.

"Open garbage dumps (the most common place we put our solid waste) have been made better by turning them into sanitary landfills. In a sanitary landfill, a layer of soil applied daily over the waste keeps pests away, cuts off water pollutants that wash off from the site after rain, does away with the need to burn the waste, and prevents wind-blowing of litter. When filled, the site can be planted with grass, shrubs, and trees and made into a park.

"However, ordinary sanitary landfills may not stop waste materials from seeping through the soil and ruining water supplies. For example, hazardous waste--chemical, radio-active, biological, flammable, and explosive types--need landfills that are sealed in special ways to prevent seepage. And Americans produce more than 10 million tons of hazardous waste each year!

"In the past, hazardous waste was burned in incinerators (furnaces for garbage) or dumped into waterways. As air and water pollution controls went into effect, however, more of these wastes were put into landfills. With 5 to 10 percent yearly increases in the amount of hazardous waste produced, the health of people is threatened by seepage of hazardous waste from the landfills.

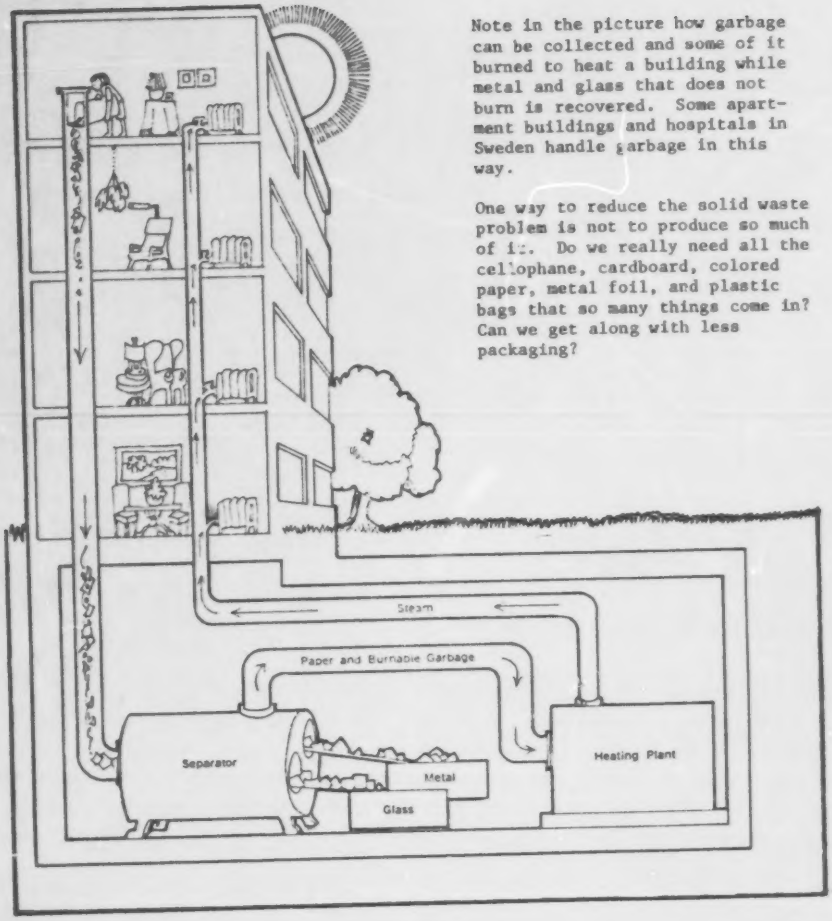
"There are good ways to get rid of most hazardous waste without harming health or ecology. But costs of such disposal are high. Federal and State and local governments are working with business firms and citizens to solve cost and other disposal problems."

Better Methods of Waste Disposal

"To recycle what we can and reclaim what is of value in solid waste is an important goal. It is probably the best method of waste disposal because it allows reuse of materials. Otherwise, solid waste is really wasted solids.

"There are a number of reasons why we recycle and recover so little solid waste today. It often seems easier and cheaper to throw many things away, although the cost of replacing, hauling, and disposing of throw-aways is increasing. We do not yet know how to reuse some solid waste, such as rubble. And we do not yet know how to recycle other waste, such as certain plastics.

"Some garbage that cannot be recycled or reclaimed now can be burned to produce energy. The city of St. Louis has a system that separates burnables from nonburnable waste. The burnable waste is mixed with coal and used as fuel in electric utility boilers."



Note in the picture how garbage can be collected and some of it burned to heat a building while metal and glass that does not burn is recovered. Some apartment buildings and hospitals in Sweden handle garbage in this way.

One way to reduce the solid waste problem is not to produce so much of it. Do we really need all the cellophane, cardboard, colored paper, metal foil, and plastic bags that so many things come in? Can we get along with less packaging?

ACTIVITIES:

1. Invite a sanitation worker to talk to the class about the kinds and amounts of garbage and trash collected in your community.

2. Take a trip to a waste disposal site that serves your community.

3. Find out what kind of laws your community has about trash and garbage disposal in your community and how well they are enforced.

4. Make an exhibit describing solid waste problems using litter found in your community for display at school or in a library.

PURPOSE: To conduct a survey to determine whether or not local acceptance of recycled paperboard is consistent with a national survey.

LEVEL: Junior high school

SUBJECT: Social Studies
Mathematics

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: "Recycled Paperboard: America is Getting the Message." American Paper Institute Inc., 260 Madison Avenue, New York, NY 10016.

The following information is from a study conducted by a leading market research firm on behalf of the Recycled Paperboard Division of the American Paper Institute.

"Americans are learning about a remarkable study on recycled paperboard which shows that--

1. Consumers believe that recycling wastepaper is much to be preferred to disposing of it in the Nation's solid waste stream.

2. There is a strong consumer acceptance of recycled paperboard. When asked their opinion of recycled paperboard as a packaging material, 91% of housewives said they liked the idea. There is a higher acceptance in some product categories than others:

Consumer Acceptance of Recycled Paperboard Packaging

Detergents	98%	Rice	85%
Beverage Containers	96%	Cake Mix	84%
Hardware	96%	Sugar	82%
Toothpaste	94%	Candy	70%
Paper Diapers	92%	Frozen Foods	66%
Crackers and Cookies	88%	Donuts, Pies	65%
Cereals	87%	Ice Cream	55%
Spaghetti	85%	Milk	55%

3. Housewives expressed preference for products packaged in recycled paperboard. In each of the above product categories at least 50% of housewives said they "definitely or probably" would switch brands if they knew they were packaged in recycled paperboard. This attitude appears to be related to the housewives' involvement in saving, bundling and setting aside their newspapers for separate collection and recycling.

4. Over half of the consumers interviewed said they would have a better opinion of companies that packaged their products in recycled paperboard. Seventy-five percent said the recycled symbol should be placed on all packages made from recycled paperboard.

5. Recycled paperboard is competitive in performance to other packaging materials, and may provide cost savings.

6. Recycled paperboard specifications can be developed to provide purchasing agents with total packaging requirements.

7. Recycled paperboard packaging material is competitive in surface whiteness and brightness and printability because the surface is made by applying higher quality fibers and coatings.

8. When carton design requires matching direction stiffness, recycled paperboard makes flatter panels with less bulge.

9. Despite some apprehension about "contaminants" expressed by packaging executives, recycled paperboard packaging must and does meet all requirements of the Food and Drug Administration for paper food packaging material.

10. Two major advantages perceived of recycled paperboard seem to be its lower price and ecological benefits.

11. Despite the findings of recent Boxboard Research and Development Association technical studies, many packaging decision-makers were misinformed about printability and scoring and folding capabilities of recycled paperboard.

12. Over half of the executives interviewed said displaying the recycled symbol on packaging has value because of the positive psychological effects on consumers and image benefits to the company's products."

ACTIVITY: From the above information, construct a questionnaire to survey your local acceptance and preference for products packaged in recycled paperboard. Conduct your survey and compare your results with the national survey. Are your local consumers well informed on paperboard recycling?

RECYCLING: ACTIVITIES FOR THE CLASSROOM

JUNIOR-SENIOR HIGH SCHOOL

PURPOSE: To show that recycling pays off.

LEVEL: Junior-senior high school

SUBJECT: Social Studies

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Blueprints for Action. An environmental resource produced by Educational Services, Girl Scouts of the U.S.A., 830 Third Avenue, New York, NY 10022, 1973.

Teachers of courses that examine environmental problems or leaders of groups such as Girl Scouts, Boy Scouts, or conservation clubs will find many project ideas in the 71-page booklet cited above. Teachers or youth leaders interested in recycling projects are likely to be interested, also, in other types of environmental education projects outlined in Blueprints for Action.

ACTIVITY: Review with a class or other youth group the project described below, together with the "Tips and Hints" to be considered when starting or conducting a recycling project.

After appropriate modification for local conditions, organize and conduct such a project.

LAKE ERIE GIRL SCOUT COUNCIL
Cleveland, Ohio

COMMITMENT

To show that recycling pays off

In the Cleveland area little space is left for disposing of discarded solid wastes. By establishing recycling centers in various parts of Cleveland and its suburbs, the team plans to demonstrate that recycling can pay for itself. Team members hope to create a demand and market for recyclable material which will finance the cost of operating the centers. By means of the recycling centers, they plan to educate consumers about recycling procedures--even to effect a change in their lifestyles.

PLAN FOR ACTION

The team has set up a recycling center for paper and glass as a pilot project at a large shopping center in a suburb of Cleveland. The long-range goal of the project is for local government to take over the recycling centers as a public service.

SPECIFICATIONS

1. Collection has been scheduled on the first Saturday of each month. Girl Scout troops will staff the center.

2. An area of the shopping center parking lot is roped off for the collection center each collection day.

3. A paper company is providing a moving van at the collection site for newspapers, cardboards, and brown paper bags, so these can be loaded and transported to the recycling plant with a minimum of labor.

4. Green, clear, and brown glass is deposited in separate dumpsters and hauled to the glass recycling plant. Safety goggles and heavy gloves are used in handling glass. Equipment has been donated by individuals and a welding company.

5. Outlets contacted for publicity include newspapers, radio and TV stations, and local businesses. Window displays in stores are being featured. Team members have been interviewed. Spot radio announcements have been written.

6. Prior to the opening day of the recycling center, Girl Scouts distributed thousands of fliers to people at the shopping center. These fliers explained how materials must be prepared for recycling.

TIPS AND HINTS

A RECYCLING PROJECT

1. Make sure a market exists for material before you collect it.

2. Approach companies who will purchase your glass, paper, aluminum cans and containers, or other cans, for the use of trucks and equipment for the collection. Discarded materials can first be deposited and then transported in the same containers.

3. Shopping center parking lots are practical for collection centers because cars can unload easily, and because a collection area can be roped off without difficulty.

4. Check on whether the collection site is insured for liability.

5. Inform local police about the plans for collection to make sure you observe any requirements for a special permit. It might be necessary for a traffic officer to be assigned to direct traffic in the collection area. If not, those working at the center should make plans to keep traffic moving smoothly.

6. Use heavy gloves and safety glasses in handling glass and metal.

7. In collecting glass, make sure it is reasonably clean, void of metal caps and rings, and sorted by color: clear, green, and amber.

8. In collecting paper, stack and tie it with twine, or put it into large grocery sacks.

9. Put the collection center on a paying basis. Sell what is collected. Use the funds to cover any costs, and to set up more centers.

PURPOSE: To examine the practice of using non-returnable beverage containers.

LEVEL: Junior-senior high school

SUBJECT: Social Studies

CONCEPT: Conservation policies are often the result of group action.

ACTIVITY: At an appropriate time during a social studies unit on natural resource use indicate that the use of "throw away" bottles and cans for beverages is a recent development in American merchandizing. Involve the class in listing the advantages and disadvantages of this development.

Ask students to examine the beverage departments in supermarkets and "carryout" stores to ascertain how many offer the customer a choice of returnable or non-returnable containers. If returnable bottles are not available, suggest that students ask the manager or one of his employees to indicate why this is the case. Have them also ask what must be done to make returnable bottles available to customers.

Pool the findings of all students in a subsequent class period. Discuss the extent to which students accept or reject the judgments expressed by store managers and/or workers. Finally, ask each student to write a short "position paper" on how he feels about using returnable rather than non-returnable beverage containers.

PURPOSE: To examine the value (use) of American trash in another social setting.

LEVEL: Junior-senior high school

SUBJECT: Social Studies

CONCEPT: The values held by a society determine what are resources and their economic worth.

ACTIVITY: Develop, with input from class students, on the chalkboard a list of materials typically thrown away as trash by Americans. The list would obviously include such items as paper, cardboard, soft drink cans, cans used in processing fruit and vegetables, glass bottles, plastic containers, pieces of wood, scraps of iron, pieces of wire, and many, many others.

After developing the list ask students (possibly working in groups of three or four) to assume that they are a family of destitute beggars in a very poor village of some underdeveloped country. Their total family income for the year is less than $50.00. They live in a hovel that provides inadequate shelter from cold, wind, and rain. The dwelling has a dirt floor. They lack fuel for cooking. Places to store water and grain are inadequate.

Ask the students (or groups) to suggest how the items previously listed (paper, cans, etc.) could be used in or near the homes of these poverty-stricken people. Encourage creative ideas such as cutting up cans to make roofing material, using newspapers and cardboard as insulating material, and so forth.

Ask students or groups to report their ideas to the class. In final discussion make a strong point of the fact that trash disposal is a problem unique to affluent societies such as ours. Recycling or reuse of materials is a matter of survival for millions of destitute people around the world. Are such conditions necessary before people take the idea of recycling seriously? What alternative pressures are possible?

PURPOSE: To examine arguments for and against using returnable beverage containers for beer and soft drinks.

LEVEL: Junior-senior high school

SUBJECT: Social Studies

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: "Questions and Answers--Returnable Beverage Containers for Beer and Soft Drinks." Publication #461, United States Environmental Protection Agency Office of Solid Waste, Publication Distribution Office, 26 West St. Clair, Cincinnati, OH 45268.

Obtain the reference cited above and make available a reading copy of the publication for each class member. Use careful reading and discussion to examine the following 19 questions and the answers found in the reference relative to returnable beverage containers.

1. What are returnable beverage containers?
2. What are the environmental and resource conservation benefits of returnable beverage containers?
3. What is mandatory beverage container deposit legislation?
4. Is there mandatory deposit legislation in existence today?
5. Does mandatory deposit legislation eliminate the use of the metal can as a beverage container?
6. How much solid waste can be prevented by such laws?
7. What about littered beverage containers?
8. How much energy could be saved by use of returnable containers?
9. How significant are these energy savings?
10. How much material could be saved through the use of returnable containers?
11. How would a returnable system affect beer and soft drink prices?
12. How many times do containers have to be returned before energy and cost savings are achieved?
13. How would a mandatory deposit law impact on the beverage production, container manufacturing and distribution industries?
14. What would be the effect of national mandatory deposit legislation on employment?
15. Is mandatory deposit legislation at cross-purposes with plants built for the recovery of energy and materials from waste?
16. Are there other mechanisms, such as the litter tax enacted by the State of Washington, that will achieve benefits similar to a mandatory deposit law?
17. Is there a sanitation problem in storing used containers?
18. Isn't there a loss of convenience to the consumer?

19. What is the position of the U.S. Environmental Protection Agency on mandatory deposit legislation at the Federal, State and local levels?

The answers given by the EPA writers, plus the possibility of further study in the readings cited in the 52-item bibliography, should permit the class to examine the issue of mandatory legislation on beverage containers rather carefully.

ACTIVITY: Engage the class in the reading and discussion suggested above. Culminate the discussion with a class vote to determine the level of support for mandatory legislation on this issue.

After obtaining the class position, give a "homework assignment" for each student to discuss the idea of mandatory legislation with an adult or two to ascertain their feelings and vote on this issue.

Compare class votes with community adult votes. If sizeable differences are apparent, try to explain why.

PURPOSE: To develop the realization that man is rapidly using up the non-renewable resources found on earth.

LEVEL: Junior-senior high school

SUBJECT: Social Studies

CONCEPT: Most resources are vulnerable to depletion in quantity, quality, or both.

REFERENCE: Human Implication of a Threatened Environment. Center for Environmental Education, 705 Avocado Avenue, Cocoa, Florida.

ACTIVITY: The table below lists some of the irreplaceable natural resources which are vital to modern industry. The United States has 6 percent of the world's people and uses between 40 and 50 percent of the world's irreplaceable natural resources. However, these facts do not become significant or impressive as long as we have a large supply of those resources. The questions which we must consider are: Do we have a limited supply of these irreplaceable resources? If so, what are our expectations for the future? The following table does not provide an answer to either of these questions, but it is an aid in understanding the existing situation. Please keep in mind all of the variables which are not taken into account such as presently undiscovered reserves, ore which is presently considered marginal, recycling, etc.

Resource	Static Reserve Index In Years	Exponential Reserve Index In Years At 2.5% Increase	Current Rate of Increase (%)
Aluminum	175	67	8.0
Chromium	560	108	4.0
Cobalt	155	63	4.6
Copper	40	28	3.3
Gold	17	14	2.4
Iron	400	98	3.8
Lead	15	13	2.0
Manganese	180	68	4.5
Mercury	13	13	3.0
Molybdenum	100	51	5.0
Nickel	140	60	8.7
Platinum	20	17	8.5
Silver	20	17	6.0
Tin	25	19	6.0
Tungsten	40	28	5.0
Zinc	18	15	6.2
Coal	900	127	3.6
Natural gas	35	25	6.6
Petroleum	70	41	6.9
Uranium	66	40	6.0

STATIC RESERVE INDEX gives the number of years our known world reserves of that resource will last if we continue consuming it as we do today.

EXPONENTIAL RESERVE INDEX shows how long the reserves will last if the usage rate increases by 2.5 percent per year.

CURRENT RATE OF INCREASE shows, for comparison, what the ACTUAL growth rate in world consumption for each resource is today.

In considering the table, have the students list those resources which are being used at the fastest rate. What are some ways in which these materials are being used? Can recycling play a role in reducing the loss of these resources? Invite a speaker from a local recycling center to discuss with the class some of the problems involved in processing material and reselling it.

PURPOSE: To examine the need for a national soil fertility program.

LEVEL: Junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity through recycling efforts is important to the welfare of people.

REFERENCE: "Befriending Our Soil: A National Soil Fertility Program." The National Soil Fertility Program, P.O. Box 4000, Pleasant Valley, NY 12569 Published in Rodale's Environment Action Bulletin, v7, n13, June, 1976.

The urbanization of America has resulted in a situation where fewer and fewer city or suburban dwellers are aware of their dependence on soil. The importance of this problem is described clearly in the following statement from the reference cited. The article also includes a "plank" that was presented for consideration at the 1976 conventions of the Democratic and Republican parties.

BEFRIENDING OUR SOIL

The soil is so much more than a medium in which to grow crops. It is the most complex ecosystem known to man, containing billions upon billions of interactive organisms in each spoonful. These organisms feed upon decaying plant and animal matter, functioning as the earth's digestive organ to turn life's discarded structures into humus. Humus gives both tilth to the soil and nutrients to the plants and animals that are born and dwell in it. Thus humus is both the product and the source of life.

The human role in this cycle has almost always been one of exploiter. We have taken our very lives from the soil in our crops and turned vegetables and meat into garbage and sewage. These end products have generally been burned, buried and dumped, creating part of our monumental pollution problems. And the soil life that depends on these wastes for its life has starved. Consequently, millions of acres of farmland have little fertility of their own and cannot grow a crop without huge inputs of non-renewable resources.

If we could only make the farm-city connection, bringing our garbage, sewage sludge, animal manures and crop wastes back to the land, the soil would bloom with life once again, regaining its fertility and ability to produce good crops, year after year, forever. The National Soil Fertility Program seeks a national commitment to put our wastes where they will do the most good: enhancing life, reducing pollution, conserving non-renewable resources, cutting back waste disposal costs, strengthening our independence and building the health of our soil and of all those who live from that soil.

A NATIONAL SOIL FERTILITY PROGRAM

Two hundred years ago, when our nation's founding mothers and fathers were still struggling for political independence, widespread patterns of land and soil misuse that mark much of our current agriculture were already established. Originally there was an average of three feet of topsoil covering what would become the continental United States. Today there is an estimated six inches or less, and even this thin layer is shrinking year after year. Through all of history, the decline of major civilizations has been directly linked to the decline of the fertility of their topsoils. Clearly the time has come to end the squandering of our country's most precious natural resource.

This goal can be accomplished by establishing as national policy the return of organic soil-building matter to the land, as organic matter is

the basis for natural soil fertility. While our soils decline, however, our waste disposal problems mount. A great part of this gross national waste is in fact organic matter, able to rebuild our soils if returned to the land. We believe that the utilization of what we now call "waste", as a valuable agricultural and national resource, will end the centuries-old decline of soil fertility in the United States. No national commitment reached in this, our Bicentennial year, will mean more to our long-term success as a people.

WE BELIEVE THAT:

--Fertile, healthy soil directly influences the health of the plants, animals and people who live from the bounty of this soil;

--Fertile soil requires less energy inputs, particularly petroleum, to produce a given crop, thus helping achieve our nation's announced goal of energy self-sufficiency;

--Fertile soil means lower costs, greater stability and increased economic security for the family farmers, farm workers, homesteaders, and rural tradesmen and their employees, whose numbers have been seriously declining in recent years, swelling the rural-to-urban migration that has added materially to our current urban fiscal crisis;

--Fertile soil will mean lower prices at the market and better quality food for the consumer;

--Fertile soil will strengthen and enhance ecological life cycles on and off the farm, requiring less pollution-causing and ecologically-disrupting substances in agriculture, and enable the farmer to take advantage of nature's built-in methods of protection against pests;

--Fertile soil stabilizes our ability to produce a sufficient quantity of food for both domestic needs and international commitments, ameliorating the occasional onslaughts of drought, erosion and pests.

WE NOTE THAT:

--Soil fertility is built and maintained by living microorganisms in the soil that cannot survive without the presence of organic matter, which they actively decompose into humus;

--Since the advent of the era of inexpensive petrochemical fertilizers, organic matter, or humus, has not been returned to the vast majority of farm acres in this country, exacerbating the destruction of soil fertility;

--The nation's urban and suburban areas are faced with costly, mounting solid waste and sewage sludge disposal problems while our rural areas are faced with increased animal waste disposal problems;

--A large component of this "waste" is organic matter which is currently burned (polluting the air), buried (polluting underground waters) or dumped (polluting our rivers and oceans and threatening our recreational areas).

THEREFORE:

It shall be our national policy to encourage the return of soil-building organic matter to our country's farmlands and to reclaim that land rendered unproductive by mining, abandonment, erosion and other consequences of our society's climb to affluence.

This shall be done by:

1. Initiating programs to make soil-building use of solid-waste and sludge a priority before incineration, landfill, dumping and gasification.

2. Developing a National Humus Mangement Program to identify sources of organic waste matter, catalogue areas of the most critical need and compile schedules of under-utilized transportation for the return of organic matter to the soil.

3. Promoting, through United States Department of Agriculture programs, the participation of all landowners in the United States in the rebuilding of our most basic and valuable national resource.

4. Encouraging individual and community gardening programs using humus or compost produced from local waste sources with municipal participation.

5. Stimulating scientific inquiry into the most environmentally-sound, efficient and economical methods of agriculture aimed at a long-term commitment to the rebuilding of this nation's soil.

6. Assisting developing nations to increase long-term food production capabilities through the use of humus management programs suited to their particular resources.

CONCLUSION

During our 200 years as a Republic, American farmers have met the challenge of producing food for our growing population at reasonable prices and providing an emergency food storehouse to aid the hungry around the world. Now, however, a combination of forces has converged to distort consumer prices, drive the price of petrochemical fertilizers beyond the reach of many farmers and create artificial shortages at a time when our emergency storehouse function is most needed. As we enter our third century of political independence, it is time to end agricultural dependence on non-renewable resources. In the finest tradition of American pioneer thrift, this National Soil Fertility Program will enable our country to curb senseless waste by using that very waste as the raw material for an agriculturally self-sufficient America--one that cherishes and maintains the soil for what it is, the source of our health and life.

ACTIVITY: Engage the class in a careful reading and discussion of the referenced article. Identify with input from the class a list of persons who ought to be concerned with a national soil fertility program such as the one proposed; since all mankind is dependent on produce from the soil, the list should include many groups other than farmers. Politicians, sewage plant operators, agronomists, organic gardeners, fertilizer salesmen, and other groups might be identified.

Assign to student volunteers the task of interviewing one or more persons from each group. What do the persons interviewed think of the proposed program? Is it, in their judgment, really necessary? Do they accept the idea that the nation's soil is in jeopardy? Do they accept the idea that we should be returning to the soil more organic material including sewage sludge? If they believe sewage sludge should be returned to the soil, what suggestions do they have to accelerate this action?

Ask each student to report his findings to the class for reaction-evaluation. In some classes all students might be asked to develop their own "position paper" on the importance of this problem.

PURPOSE: To examine the potential of "fish gardening" as a recycling process.

LEVEL: Junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: Social values and mores influence personal conservation behavior.

Fish farming has been used as a source of high-quality protein in China for centuries. Near a Chinese home may be located a small pond situated so that it receives water run-off from the family pig-sty. The fertilizer draining into the pond encourages the growth of small organisms in the pond. The organisms start a food chain that results in substantial production of edible fish.

The Chinese, with enormous pressure to produce food for their population of 800,000,000 people, have developed the science of fish farming to a very high level. They will, for example, put into a pond with a depth of 8-10 feet several varieties of fish that live at various depths; grass-eating carp will be found on the top, plankton-eating carp in the middle, and a bottom-feeding carp below. In this arrangement each lower species benefits from (recycles) the waste products of the one above.

Many persons are unaware of the efficiency of fish as protein producers. Since things weigh less in water than they do in air, fish use very little energy to support themselves, in contrast to beef animals who use considerable energy simply to stand. Secondly, since fish are cold-blooded and simply change their temperature to match that of the water they are in, fish use no energy to keep warm in the winter or cool in summer.

Simply put, a ton of fish food put into a properly-designed fish pond will produce substantially more protein than a ton of cattle food will produce in a well-designed beef feedlot. And the fish food can consist, in part, of food scraps and other waste materials.

ACTIVITY: Involve the class in examining the practicality of fish gardening in the United States. Under what circumstances is a relatively small fish garden or pond practical? Are farm ponds frequently found along interstate highway construction used as fish farms? If so, what can be done to increase their productivity?

Suggest that students contact leaders of local sportsmen's clubs, well-known fishermen, appropriate personnel in State Departments of Natural Resources, or university specialists in ichthyology to get background information prior to a class discussion on the topic.

PURPOSE: To overview recycling developments and waste utilization research.

LEVEL: Junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: Social, economic, and technological changes alter the interrelationships, importance, and the need to recycle natural resources.

REFERENCE: National Distribution Center for Bureau of Mines Motion Pictures, 4800 Forbes Avenue, Pittsburgh, PA 15213.

ACTIVITY: Secure from the Center cited above the film "Wealth Out of Waste." The 27-minute color film, available at no cost except return postage, "tells the story of recycling and waste utilization research, which holds promise for turning the rubbish heaps of our affluent society into valuable resources for supplementing the nation's declining mineral reserves. It identifies the variety of wastes generated in the U.S. today; examines Bureau of Mines research activities concerned with recycling of urban refuse and other wastes; and shows many useful products resulting from the Bureau's waste utilization research. Recycling, the film concludes, promises a rewarding solution to a doubly challenging conservation problem--abating the environmental blight caused by waste, and saving the mineral values they contain."

Follow the showing of the film with a discussion period examining questions such as: What factors have been responsible for the enormous growth of our waste disposal problem? What is meant by selective recycling? What waste disposal problems are unique to cities; to rural areas? Is it appropriate for the government, as represented by the Bureau of Mines, to use taxpayer money to work on this problem and/or to make a film such as this for free use in schools?

PURPOSE: To understand the continuous recycling process of nature and to see how man himself is a major interfering factor in this process.

LEVEL: Junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Environmental Education Instructional Activities for Grades 7-12. New York State Education Department.
ED 045 437

ACTIVITY: Review with students the cycle by which animal wastes and dead animals and plants revert back to the soil where they are available for future plant and subsequent animal use.

Through questioning help students understand how man's wastes and dead bodies are, in the U.S.A., notable exceptions to the general cycle. Get students to estimate the amount of organic material man takes from the soil which he flushes into rivers or other bodies of water. Is this material "lost"? What happens to it? Does it return to the soil? Who, if anyone, should be concerned about this problem? What practical answers can students suggest?

PURPOSE: To examine the importance of waste reduction in the nation's recycling effort.

LEVEL: Junior-senior high school

SUBJECT: Social Studies
Science

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Skinner, John H. "Reduce the Incentive to Waste." Resource Recovery Division, Office of Solid Waste Management Programs, U.S. Environmental Protection Agency. A paper presented September 8, 1975 at the 80th National Meeting of the American Institute of Chemical Engineers.

Excerpts from the cited nine-page paper that may be helpful to teachers are as follows:

Waste reduction differs from recycling and resource recovery which are activities oriented toward extraction and utilization of materials from solid waste and the conversion of waste into a usable product. Waste reduction simply means producing less waste in the first place.

Some examples may be helpful. Waste reduction includes:

a. the use of a product with a longer lifetime, such as a 40,000-mile automobile tire rather than a 25,000-mile tire,

b. the use of reusable products (beverage containers, plates and cups, utensils, napkins, linens, diapers, ...etc.) rather than so-called "disposable" products designed for single use,

c. reducing the quantity of material used in a product (e.g. smaller and lighter automobiles).

Each of these activities results in a reduction in the quantity of waste generated when the product is discarded.

Waste reduction is embraced by the environmental community and many public interest and consumer groups as the vanguard of environmental protection, representing one of the basic changes in lifestyle that is necessary in order to conserve important resource supplies and avoid long-term irreparable degradation of the environment. On the other hand it is fiercely opposed by many industrial and business interests as an oppressive, unnecessary and restrictive intrusion into the free-enterprise market system.

In 1973, 144 million tons of residential and commercial solid wastes were discarded in the United States. Approximately 9 million tons of these wastes were recycled (mainly paper and paperboard) leaving 135 million tons to be disposed of in dumps, sanitary landfills and incinerators.

Our projections indicate that by 1985 waste discards will grow to over 200 million tons annually. However, resource recovery is also expected to grow. Approximately 20 million tons of waste are projected to be recovered in municipal resource recovery facilities designed primarily to convert the combustible waste fraction into energy. Paper and paperboard recycling is also projected to increase to 15 million tons resulting in a total recovery level of 35 million tons. This would leave approximately 165 million tons to be disposed of.

In other words, solid waste disposal requirements are projected to increase from 135 million tons in 1973 to 165 million tons in 1985 or an increase of 22 percent.

Now let's consider a more rapid rate of resource recovery plant installation such as doubling the projected level of such plants by 1985. This would mean the construction of 25 to 50 additional plants by that time. Such a rate of resource recovery plant implementation would still leave over 70 percent of the waste stream unrecovered by 1985--or 145 million tons destined for disposal. In other words even with a very optimistic rate of resource recovery plant construction, waste disposal requirements would still increase between 1973 and 1985. Resource recovery would not even keep pace with the growth in the waste stream. This fact in itself calls for investigation of other alternatives.

Any meaningful attempt to address the waste disposal requirements of our Nation must move beyond to the construction of energy recovery facilities to include:

a. programs to reduce the generation of waste in the first place, and

b. programs to increase the recovery and reuse of paper and other materials.

It is important to note that product design and consumption trends do affect waste generation. The trend towards the use of disposable products increases the amount of solid waste generated. For example, on a per capita basis, packaging material consumption and waste generation increased by over 40 percent between 1958 and 1971. The point is simply that solid wastes are primarily discarded products and the rate of consumption of such products affects the costs and difficulties of handling solid wastes.

The rationale for a governmental role in waste reduction lies in the realization that although solid waste management costs and problems are in a large part determined by producer and consumer decisions there is virtually no economic incentive for producers and consumers to modify their behavior on this account. A producer bases his decisions on the costs that he directly experiences, not on the costs incurred by another that must dispose of his product. It is very difficult for a consumer to relate his purchase decisions to the costs of product disposal. In many communities solid waste management charges are hidden in general property taxes. The local public agencies and private firms that collect and dispose of solid waste, and directly incur the costs of waste management, have virtually no influence over the quantity of waste produced. As a result waste generation rates increase in an uncontrolled manner.

Similarly production and consumption decisions are not made with full consideration of the long-term limitations on the supply and availability of natural resources. These decisions are generally based upon short-term profit or benefit maximization and the costs to future generations are generally not adequately reflected. In this area certain government policies such as depletion allowances, foreign tax credits, and other favorable tax treatments actually stimulate consumption of natural resources and thereby provide a disincentive for conservation and use of waste materials.

The fact that product design and consumption decisions influence both solid waste management costs and resource utilization costs and that these costs are not reflected into such decisions is an indication of a market failure. Appropriate cost signals are not reaching the participants who can influence these costs. If such costs were in some way reflected in product prices, producer and consumer decisions would act to limit waste generation rates. The need to correct these market failures is the crux of the rationale for government programs to attempt to stimulate waste reduction. Waste is a byproduct of our production and consumption system, but the system is not accounting for the costs of waste generation.

The extent of the Federal government's role in waste reduction is limited by the authorities legislated by the Congress. The Solid Waste Disposal Act provides for the development and dissemination of information and for Federal leadership and direction. While this is a very important activity in that

it provides information to producers and consumers concerning the solid waste management ramifications of their actions, it does not provide any incentive for a change in behavior.

A number of bills before Congress have set forth more active Federal roles in this area of waste reduction. One approach that has been suggested calls for the development of national standards for consumer products based upon criteria such as reusability, useful lifetime, material content, and other factors. This is certainly the most objectionable approach to the business and industrial community in that it involves direct government intervention into product designs. Such an approach could entail high administrative costs if applied to the numerous product categories in the waste stream. Regulation may nevertheless be appropriate for certain select items that result in extremely difficult waste disposal problems or very high disposal costs.

A second approach that has been suggested appears to be more oriented toward direct adjustment of the market failures previously identified. This approach involves providing direct economic incentives or disincentives to the producers and consumers. One specific proposal involves placing a charge equal to solid waste management costs on all consumer products and disbursement of the revenues collected to local solid waste management agencies. A second proposal involves the placement of refundable deposits on items such as beverage containers, to provide an incentive for their return and a disincentive for their disposal or littering. A third involves adjustment or removal of virgin raw material tax benefits. The economic incentive approach has certain advantages in that while it readjusts economic signals to reflect all costs it allows the market system to determine final product choices.

In EPA we are continuing to explore the various options which could be employed to reduce waste generation. Progress in this area is very slow because the concepts are new to us all, and we may be at the forefront of a new perception of how to deal with environmental problems. We must continue to promote conventional approaches to solid waste management. We must strive to control environmentally unacceptable disposal practices. We must accelerate the construction of resource recovery plants. But at the same time we must now begin to face the fact that in the formulation of overall federal solid waste management policy, we must also address the compelling need to reduce waste generation.

ACTIVITY: Engage the class in developing a list of the substances most commonly found in America's solid waste disposal stream. The list would certainly include such substances as paper, cardboard, glass, cans, junk automobiles, refrigerators, and many other products spewed out by our consumer-oriented throw-away society.

Discuss, as time and interest permit, several substances on the list. In the years ahead, should emphasis be placed on reducing the incentive to "waste" the substances or on recycling them? What role should be played by government in reducing waste? Is this a matter that should be worked out in a free-market economy without any governmental concern?

At the senior high school level, the class discussion might be followed by the assignment that students write a short position paper on how "The Incentive to Waste" can be reduced in our country.

PURPOSE: To examine a problem caused by nature's recycling of materials deposited in sanitary landfills.

LEVEL: Junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: Safe waste disposal, including the reduction of harmful and cumulative effects of various solids, liquids, gases, radioactive wastes and heat, is important if the well-being of man and the environment is to be preserved.

Recently a problem associated with sanitary landfills has arisen in a few locations. The recycling, or breakdown, of garbage by natural microorganisms in the anaerobic (without oxygen) conditions found in large landfills results, among other products, in the production of methane gas. This gas, which is the main constituent of natural gas, has been known to move through cracks between layers of rock into basements of homes built near landfills. Recently in New York a court awarded damages to an owner whose home was found to be unsafe to live in because of gas movement from a nearby sanitary landfill.

ACTIVITY: Engage the class in discussing the problem cited above. Should a city or community be held responsible for gas or other pollutants escaping from their sanitary landfills into homes, water tables, streams, or air? Should real estate developers or home builders be prohibited from building on sites where pollution from landfills is a possibility?

If possible, arrange for a trip to the community's sanitary landfill and elicit judgments from the person in charge about the potential for pollution movement from that site. Elicit also judgments about the amount of landfill material that possibly ought to be recycled rather than buried. If a class visit to the landfill cannot be arranged, substitute a visit and interview by a small group of students who will report to the class. A class or school appearance by a spokesman of the city or community's sanitation service to respond to questions is another possibility.

PURPOSE: To become involved in a project to use worn-out automobile tires.

LEVEL: Junior-senior high school

SUBJECT: Science
Social Studies

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

Fishing is an extremely popular outdoor recreational activity. Sporting magazines have reported that many communities have improved the fishing in lakes and coastal waters by creating artificial shelters for spawning fish and small fingerlings.

Worn-out automobile tires can be wired together and sunk into fairly deep water. The subsequent piles of rubber tires provide the environment needed for small fish to hide from their natural predators until they reach a size more likely to assure survival. The tires also provide surfaces on which can grow the small plants and animals that provide basic food for small fish that are needed to support a diversified fish population.

ACTIVITY: Ask a small group of students (2-4) to use the Readers' Guide to Periodical Literature and/or the help of a librarian to locate an article or two that describes a successful attempt to create artificial fishing grounds with worn-out automobile tires.

After acquiring an understanding of the successful efforts, make arrangements for the students to contact leaders of local sportsman or fishing clubs to ascertain their interest in a joint venture to improve local fishing. Presumably, avid fishermen will know about the success of other groups or clubs in using this procedure.

Indicate the willingness of a class or a sizeable group of students from the school to work with the adult sportsmen in doing the labor involved in assembling tires, wiring them together, and sinking them in the places selected by the persons most knowledgeable about such matters.

A project of this type provides excellent opportunity for good school publicity through media such as local newspapers or television.

PURPOSE: To operate a small recycling program using earthworms.

LEVEL: Junior-senior high school

SUBJECT: Science

CONCEPT: Maintaining, improving, and in some cases restoring soil productivity through recycling efforts is important to the welfare of people.

Earthworms play an important role in improving the porosity of soil. As earthworms ingest, digest, and excrete material found in soil, they improve fertility as well as porosity or water-holding capacity. Earthworms are very efficient producers of protein and, repulsive as it may seem to Americans at the present time, they are eaten by people in some cultures.

Earthworm farming is a profitable business for some entrepreneurs who grow them by the thousands and package them for sale to bait stores or others who cater to fishermen. Literature describing how to get started in the worm raising business can be obtained by writing to addresses found in the "for sale" sections of national sporting magazines such as Field and Stream.

ACTIVITY: Secure, if possible, directions for raising earthworms from a source such as the one cited above. To the extent possible follow the directions in a science classroom. Observe over a period of several weeks what is happening to the porosity and appearance of the soil. What is happening to the number of earthworms? What size operation would be large enough to produce salable quantities of "fishworms"?

Experiment with various foods for earthworms such as leaves, dried plant roots, and small pieces of garbage. How efficient are earthworms in converting these substances into the soil-like material they excrete?

It might be possible, also, to divide the box in which the worms are to be grown. On one side start with good garden soil and on the other with a poor "clayey" soil. Treat both sides the same in terms of numbers of worms implanted, in feeding, in watering. Which side is operating as the more efficient "recycling center"? Why?

PURPOSE: To investigate laws/controls regarding returnable beverage containers in your local community and state.

LEVEL: Junior-senior high school

SUBJECT: Social Studies
Language Arts

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: "Recycling" (Special Issue). Rodale's Environment Action Bulletin, v5, n1, January 5, 1974, pp. 4,5. Rodale Press, Inc., 33 E. Minor St., Emmaus, PA.

ACTIVITY: Distribute to your class the following information reprinted from the bulletin listed above:

GLASS: 60 Billion Throwaways Going on 100--
An Industry Thrives on Waste.

For many years almost all beverage containers were returnable, mostly because in those days, you didn't throw away a perfectly good bottle. But in its constant search for ways to both pamper the public's penchant for being pampered and to make more money, the beverage industry hit upon a staggeringly successful ploy--the convenience of the throwaway bottle.

Throwaways came out in earnest after World War II, and today control well over half the market. The big container manufacturers openly talk about going for 100 billion throwaway beverage containers in the near future--up from the current 60 billion made each year.

Many people seem willing to throw the bottles away--anywhere. In Oregon, a state known for its natural beauty, roadsides were filling up with throwaways. Elsewhere, concerned citizens saw their towns inundated under a flood of glass bottles and began small-scale recycling centers to help shovel some of the mess back at the glass companies.

Public Relations Moves

The glass companies were only too willing to have people do their work for them. The Glass Container Manufacturers Institute started running advertisements in the early 1970's encouraging citizen recycling. Collections increased from nearly nothing in the late 1960's to 960 million bottles recycled in 1972, according to GCMI. It was a good public relations move, making the bottlers seem responsive to citizens' recycling efforts. But, in effect, it didn't touch the problem: 960 million bottles is less than one out of every 33 manufactured that year.

In other words, it would take at least the balance of this millenium, recycling at the current rate, to clean up the bottles made in 1972 alone.

What industry wants is to go on making as many bottles as possible for as long as possible. If people think they are helping the environment by collecting these throwaways and returning them so the glass can be remade into new bottles, that's all to the industry's good. But the idea is to make bottles, for each bottle carries a bit of profit.

In 1972, things started to change. In Oregon a law was proposed--a law unthinkable just a few years ago--placing a nickel deposit on all bottles and cans, thus making them all returnable. Almost immediately after the law was passed, the roadside litter problem improved. And worse for industry, this law was followed by one in Vermont. And now there's national legislation to do the same thing, still before the Senate Commerce Committee (S. 2062, sponsored by Oregon's Sen. Mark Hatfield).

Industry saw that if it had to collect and refill its own bottles, its distribution areas would be severely limited and the monopolistic trends of recent years would be reversed. As Peter Chokola, a small independent bottler in Wilkes-Barre, Pa. has repeatedly stated, the big bottlers favor throwaways because they are even more of a convenience for the bottler than for the consumer. They enable giant bottlers like Coke and 7-Up and Dr. Pepper, Budweiser, Miller and the rest, to move their product just as widely as possible. The little guy is forced out.

And so, with legislation which might cripple the industry staring it in the face, industry public relations groups started fighting dirty. In news releases, they distorted and twisted facts. And they did it to the point that even pro-industry soft-drinks magazines said they were making more enemies than friends among the people.

Those earnest citizens who manned local recycling centers also began changing the nature of their work. Members of the Carlisle, Pa., Recycling Center last year refused to handle throwaway bottles, urging recycling center patrons to purchase beverages in returnables only.

"Recycling containers is not nearly as good as returning them," the group said.

There are plans underway now by big beverage bottlers to clear all returnables off the shelves of supermarkets in favor of throwaways, before a return to reusable bottles becomes more widespread. An avowed aim of the Glass Container Manufacturers Institute's clients is to produce all-throwaways, 100 billion of them a year within a decade.

But this can be turned back by citizen action. The Lehigh Valley (Pa.) Environmental Federation sent a spokesman to talk to the local Pantry Pride chain manager, after the group heard that all returnables were slated to be taken off the shelves within a few weeks. The zone manager was glad to talk with him, and without resorting to boycotts or other high pressure tactics, the federation found that at least half the shelf space was earmarked for returnables.

While glass recycling centers make an important contribution to the environment--they trap some of the stuff that would otherwise be wasted in landfills--three years of recycling with only a 3 percent return has shown that more must be done.

Most important is the passage of bottle bills such as the one enacted in Oregon--at state, local and national levels. This cannot be done by individuals; it must be done by government. And, with industry opposition strong, many legislators will be less than anxious to put themselves on the line for it unless they hear from their constituents.

Write the following organizations for further and current information on the bottle bill:

Environment Action Bulletin, 33 E. Minor St., Emmaus, PA 18049. Ask for the special issue on the bottle bill (March 24, 1972).

Oregon Environmental Council, 2637 S.W. Water Ave., Portland, OR 97201. Ask for "Oregon's Bottle Bill--One Year Later." ($1.50)

Environmental Protection Agency, Public Affairs Office. Write your regional office and ask for "Oregon's Bottle Bill--The First Six Months."

Assign your students to find out whether your local community and state have controls on throwaway containers by writing to town, city, state and national representatives.

PURPOSE: To become aware of the determinants of the types of materials chosen for packaging consumer goods.

LEVEL: Junior-senior high school

SUBJECT: Social Studies
Language Arts
Fine Arts

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Giebelhausen, Maribeth R. and others. Trash--Our Only Growing Resource. Missouri State Dept. of Education, Jefferson City, Missouri; Parkway School District, Chesterfield, Missouri, 1973. Title III ESEA. ED 098 070

"Modern products are designed to contain and protect the form and quality of a product and to facilitate its timely and efficient movement through trade channels. And, let it be added in the same breath, to attract and please customers."[1] The consumer does play an important role in determining the types of materials used in packaging because in is he that has to be persuaded to purcahase the product. If the consumer is not attracted by the product or the package that contains the product, it is likely that the consumer will pass it by. Industries have to keep the wishes and likes of consumers foremost in mind. Therefore, "to utility have been added color, art, design, imagination, and convenience. Plain bottles have become attractive decanters. Boxes that contain pancake and biscuit flour carry recipes. Cheese comes in gay tumblers. Bags that protect carrots can be put to a dozen uses in a kitchen. Tins for cake and candy are almost like jewel boxes. But with all that, the packages have to be cheap enough to permit a commercially feasible method of distribution, and they have to provide some benefits to growers, distributors and users of the product."[2]

"A processor considers a number of factors in selecting materials and types of containers. Generally, he tries to select a package that most economically meets such basic requirements as protection and preservation of quality, convenience, preferred sizes, and attractiveness."[3] All of these characteristics relate directly to the consumer and to his preferences.

Using all characteristics mentioned, the processor and packager work together to create a packaged product that meets all needs. "For example, not long ago all red meats were packaged for the customer after she had made her selection from the meat counter. But, in order to adapt red meats to self-service merchandising, the meat had to be cut, weighed, and wrapped in some type of package before being placed on retail display--a development commonly referred to as prepackaging. We like to see the particular cut of meat that we buy, not generally feasible until the development of satisfactory transparent films. Visibility was important, but other packaging problems also arose because of the characteristic of red meat. It generally is bright red immediately upon being cut and becomes dark red soon after being exposed to the oxygen in the air. The extent of the oxidation process and subsequent darkening of the meat, after a long period of exposure to the air, is related to the amount of oxygen to which the meat is exposed. A special type of cellophane had to be developed which would permit enough - but not too much - oxygen to penetrate the package."[4] In this example, it is evident

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1. United States Department of Agriculture, Marketing--the Yearbook of Agriculture--1954. Washington: United States Government Printing Office, page 132.
2. Ibid. p. 132
3. Ibid. p. 135
4. Ibid. p. 133

that much cooperative thinking must be done to accomplish the task of producing a product that is attractive, convenient, and maintains good quality for the customer.

Shapes and sizes of the packages must also be acceptable to the consumer and often this is a matter of trial and error by the packager. "For example, in a test period of 3 weeks, consumers in three cities showed a preference for apples in 3 or 4 pound bags over similar apples in 5 pound bags. The design of the package is important as well - square milk bottles require one-third less space than round bottles. Short ketchup bottles tip over less easily than tall bottles. A package should not fall apart on the way home. It has to be easy to open. Potato packagers have found out that the customer does not want to unfasten the wire tie with a pair of pliers. Consumers complain when they cannot close a cellophane bag after using part of the contents."[5] All these points illustrate how the consumer must be considered when designing all packages.

The average family spends at least $200.00 of its yearly budget just for the package, which is eventually thrown away.

ACTIVITY: Discuss with your class the types of packaging materials that are recyclable, such as: glass, metal cans, paper packages, cardboard, etc.

The following types of packaging cannot be recycled: plastics, plastic products such as styrofoam, and cellophane. (Plastic-coated paper packages can be recycled if the plastic is removed; however, the process is so expensive that tney usually are not recycled.)

Ask your students to bring from home a package that is recyclable and one that is not. Discuss the characteristics of their packages in terms of:

1. The aesthetics of the package (attractiveness, good lines, display of the product)

2. Ecological soundness (biodegradable, use of minimum resources to produce wasting of resources

3. Appropriate packaging for the product (protect and preserve the quality of the product, preferred sizes, convenience)

4. Advertisement (psychology of packaging: is it advertised honestly? Does it make the product appealing to all?)

Now, choose a product and secure 4 or 5 packages that contain the product. For example, choose a product such as green beans and bring to class green beans in a can, in a jar, in frozen paper packages, frozen in a plastic bag, etc. Display the packages where all can see them well. Ask the students to choose a package which they think the majority of the class would purchase. Tell them to base their answer on the packaging type. Also, ask them why they chose the package.

Divide your class into small groups. Assign each group the task of choosing a product and designing the packaging materials that suits all aspects of correct packaging, also keeping in mind the ecological soundness of the package. Have each group develop an advertising campaign for their product. They may decide to write a radio or TV commercial to sell their product.

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5. Ibid. p. 134

RECYCLING: ACTIVITIES FOR THE CLASSROOM

SENIOR HIGH SCHOOL

PURPOSE: To examine the importance of group action in promoting conservation-recycling legislation.

LEVEL: Senior high school

SUBJECT: Social Studies

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

State legislation designed to discourage the sale of throw-away containers for soft drinks and beer is in effect in Oregon. Similar legislation, soon to go into effect, has been passed in Michigan and Vermont. So-called "bottle bills" have been introduced into the legislatures of many more states and into the U.S. Congress.

Efforts to pass such legislation, particularly at the state level, result in the coalition of several groups whose aim is to defeat such efforts. The can makers, large brewers, large soft-drink manufacturers, and in some cases unions whose workers operate specialized bottle or can-making machinery collect and use sizeable funds to lobby against the passage of such legislation. The funds are also used to present their case very effectively on TV or in print media.

Against this rather powerful array of manufacturers and businesses interested in maintaining the distribution system now in effect, an individual or small group interested in promoting the passage of "bottle bill" legislation faces a formidable task.

ACTIVITY. Challenge several of the better students in the class to investigate the pressure groups organized for and against bottle bill legislation. Ask that they make special efforts to find out the groups that were organized in favor of such legislation in the states of Oregon, Vermont, and Michigan, where such legislation has been enacted. What already established groups such as League of Women Voters, the Sierra Club, local conservation clubs, and so forth, were involved? How was funding obtained? How were volunteers recruited?

Challenge the students to contact reference librarians, Readers' Guide to Periodical Literature, legislators and/or conservationists known to favor such legislation to identify persons, groups, or projects that played a role in passing state-level bottle legislation. Contact identified persons for resumes of how they organized and worked to accomplish their goals.

Finally, ask the students to report their findings to the class (or classes) and lead a discussion on what they have found. What, if anything, are the implications of the findings for the local community or state? How many students would be willing to participate in an effort to promote such legislation in their state?

PURPOSE: To examine constrasting approaches to recycling.

LEVEL: Senior high school

SUBJECT: Social Studies

CONCEPT: Social values and mores influence personal conservation behavior.

In recent years several cities have built huge highly mechanized plants to sort the garbage and trash collected by their sanitation departments. The plants are engineered to separate out components such as steel, aluminum and glass, with the intention of burning the combustible remainder, consisting of paper, plastics, food scraps, and other materials to produce energy for making electricity. Such plants, often costing as much as 100 million dollars, are built with public tax funds. Once such a plant is built, the city is "locked in" for many years into a single specific garbage disposal system. And the system offers some, but limited, opportunities for recycling.

It is argued by some ecologists that a huge, centralized, complex system such as that suggested above is energy wasteful and unnecessary. Used newspapers ought to be recycled into newsprint rather than burned. Grass clippings and leaves from the city's homeowners ought to be recycled through composting into fertilizer rather than burned to get the very small amount of heat such materials provide. With very little use of energy, homeowners can separate aluminum from steel cans, and separate glass from other garbage. Some advocates of recycling believe that cities should work much harder to develop garbage and trash collecting systems that will make homeowners active participants in recycling efforts. More emphasis, they say, should be placed on what individuals (or families) can do and less emphasis placed on big, expensive, technical solutions to the problem of obtaining wealth from the waste thrown away by American consumers.

ACTIVITY: Present to the class, in general outline, the two contrasting approaches cited above. Ask several students to research the advantages and present the strongest case they can for the huge garbage sorting-burning plant. Ask an equal number of students to do comparable research and presentation for the alternative approach.

Select five-seven students to serve as a "city council" that is being asked to approve a bond issue to fund a proposed huge plant. Advocates of the contrasting positions should "present their case" to the council and respond to questions that might arise.

Finally, ask each council member to vote for or against the 100 million dollar bond issue on the basis of arguments presented and/or his own convictions. Does the entire class agree with "council's" decision?

PURPOSE: To examine factors mitigating against recycling.

LEVEL: Senior high school

SUBJECT: Social Studies

CONCEPT: Economic efficiency does not always result in conservation of a natural resource.

REFERENCE: "The Hang-ups on Recycling." An editorial in Environmental Science and Technology, v9, n12, November 1975, p.1015.

ACTIVITY: Review with the class the fact that certain tax laws are unfavorable against recycling projects. A paper company, for example, that uses recycled paper would be liable for taxes up to 48% of earnings, while another company that uses wood cut from its own forests would pay, through depletion allowance credits, considerably less.

Freight rates for hauling recyclable materials such as scrap iron are generally 50-100% higher than for hauling virgin ore.

Ask three members of a class to write to (1) The U.S. Interstate Commerce Commission, (2) the area U.S. Representative in Congress, and (3) one of the state's Senators. Indicate dismay with the present situation that discriminates against recycling efforts needed to save energy and conserve diminishing resources. Inquire what, if anything, is being done to reverse the situation. Inquire,also, as to what can be done by concerned citizens.

Discuss in class the responses obtained.

PURPOSE: To examine, in detail, problems associated with recycling iron and steel.

LEVEL: Senior high school

SUBJECT: Social Studies

CONCEPT: Social, economic, and technological changes alter the interrelationships, importance, and the need to recycle natural resources.

ACTIVITY: Write to the Institute of Scrap Iron and Steel, Inc., 1627 K Street, NW, Washington, DC 20006, and ask to be placed on their mailing list to receive Phoenix Quarterly. This small publication issued every three months provides some of the latest information available about problems associated with recycling iron and steel in the United States.

Secure from the magazine or from other publications or films available from the Institute of Scrap Iron and Steel, materials such as those listed below that represent its point of view. Select and use as class presentation-discussion, or for individual study, material you deem useful for examining this important area of recycling.

Publications and Films Available from ISIS:

Recycling Iron and Steel Scrap Saves Energy

Mines Above Ground--Scrap: The Supernatural Resource

"Scrap Processors and Resource Recovery. . .The Need for Expanded Markets," reprint from the NCRR Bulletin.

Government's Role in Resource Recovery

Recycling Ferrous Scrap Saves Energy

Municipal Solid Waste and Resource Recovery: Position Statement and Observations

Discriminatory Railroad Freight Rates

Ferrous Scrap--An International Commodity

Motor Vehicle Detitling

Tax Equity for Ferrous Scrap

Facts--1976 Statistical Yearbook ($2.00)

Specifications for Iron and Steel Scrap ($.50)

"Scrap: The Supernatural Resource": 16 mm sound film, color, 28 minutes, available on free loan by writing Modern Talking Picture Service, 2323 New Hyde Park Rd., New Hyde Park, NY 11040.

"It's Our Choice": 11-minute color, sound slidefilm. Free loan from ISIS.

PURPOSE: To examine problems associated with recycling scrap iron and steel.

LEVEL: Senior high school

SUBJECT: Social Studies
Science

CONCEPT: Economic efficiency does not always result in conservation of a natural resource.

REFERENCE: Phoenix Quarterly. The Institute of Scrap Iron and Steel, Inc., 1627 K Street, N.W., Washington, DC 20006. v9, n4, Winter 1978.

Discarded automobiles, worn out refrigerators, and many other rusting steel and iron products are prominent in the American landscape. The enormity and ugliness of some automobile "graveyards" has resulted in efforts to have them zoned to less conspicuous locations or to require that they be hidden behind fences.

Such steel and iron scrap can be considered, however, as an economic resource rather than an aesthetic eyesore. The publication cited above reports that by the end of 1975 the United Staces had more than 636 million tons of ferrous discards available but not being recycled; and the backlog is growing by an average of more than 13 million tons a year. The Institute of Scrap Iron and Steel argues forcibly that expanded use of scrap iron would make significant contributions toward (1) slashing energy consumption, (2) conserving natural resources, and (3) cutting air and water pollution. The institute is convinced that freight rates and tax benefits are such as to encourage steel manufacturing companies to use iron ore rather than scrap iron in their blast furnaces. The institute argues that freight rates and tax benefits should be equalized for iron ore and scrap. Some persons would go further and argue that rates and taxes should be set up to favor use of scrap and penalize use of virgin ore.

ACTIVITY: Assign to a small group of students the task of researching problems that are associated with using scrap iron in steel making. Encyclopedias and other references can be used but might be augmented by interviews with persons knowledgeable about metallurgy and/or steelmaking.

Assign to another group of students the task of researching how freight rates are determined. Railroad and trucking personnel and governmental officials of the Interstate Commerce Commission should prove to be helpful.

Assign to still another group the task of interviewing scrap iron dealers or junkmen in their community to solicit their perceptions of the problem. What solutions do they propose?

Ask each group to report its findings to the class together with their recommendations of what, if anything, should be done about the growing scrap iron problem in this country. Search for class concensus or areas of disagreement.

PURPOSE: To examine the idea of recycling used motor oil.

LEVEL: Senior high school

SUBJECT: Science
Social Studies

CONCEPT: Economic efficiency does not always result in conservation of a natural resource.

REFERENCE: McEwen, L. B., Jr. "Re-refining of Waste Lubrication Oil: Federal Perspective." Resource Recovery and Energy Review, 3(6): 14-17, November/December, 1976.

Data from the Federal Highway Administration, published in the 1977 The World Almanac and Book of Facts, reports that the United States had approximately 133 million registered autos, buses and trucks in 1975. It is certain that the number has increased since then. It is likely that the motor oil in each vehicle is changed two times or more often each year.

When oil is changed at a service station or large garage, the used oil is stored and picked up for re-refining. However, many, many automobile owners or drivers save more than 50% on the cost of an oil change by buying their oil at a department or automotive specialty store and changing it themselves. In these cases, the used oil apparently seldom gets recycled. It may be thrown away in the garbage pick-up stream, burned, dumped into storm sewers, or disposed of in other ways.

ACTIVITY: Engage the class in surveying how many of the families represented change the oil in their motor vehicles personally and how many have this done in a service station or garage. If the oil change is made "at home", what is done with the waste oil? Are the disposal practices damaging to the environment in any way?

Prior to class discussion along the lines suggested above, have a volunteer or two from each class check with a few service stations to see what they do with the used oil they collect. How much is it worth? Do they have suggestions about what should be done with the few quarts of used motor oil collected by the car owner who prefers to "change his own"? Use these suggestions in the class discussion.

Discuss similarities and differences in points of view held by class members, their parents, and service station operators. Is recycling of motor oil really important enough to worry about it?

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PURPOSE: To investigate the variety of careers related to recycling and the type of training needed.

LEVEL: Senior high school

SUBJECT: Social Studies
Science

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Giebelhausen, Maribeth R. and others. Trash--Our Only Growing Resource. Missouri State Department of Education, Jefferson City, Missouri; Parkway School District, Chesterfield, Missouri, 1973. Title III, ESEA. ED 098 070

ACTIVITY: Ask your class to help you list jobs related to recycling. Your students will probably come up with a few of the obvious ones such as running a recycling center and landfill operators and supervisors.

Point out that many career opportunities exist that are related to recycling, including:

1. Advertising
2. Packaging design
3. Marketing
4. Microbiologist
5. Chemist
6. Engineer
7. Laboratory technician
8. Grocer
9. Landfill supervisor
10. Bulldozer operator
11. Farmer
12. Urban planner
13. Writer
14. Garbage collector
15. Truck driver

Discuss each of the above jobs and how they can relate to recycling. Invite your guidance counselor to discuss the type of training necessary for the various careers.

PURPOSE: To examine a more natural approach to sewage treatment.

LEVEL: Senior high school

SUBJECT: Science

CONCEPT: Social, economic, and technological changes alter the interrelationships, importance, and the need to recycle natural resources.

REFERENCE: Kemper, Clay. "Sewage Treatment Plants (and Animals). " Rodale's Environment Action Bulletion, v9, n1, January 7, 1978.

The article cited above describes an unconventional method of sewage treatment being tested in three California locations. The approach, called Solar AquaSystems Process, developed by biologists Steve Serfling and Dominick Mendota; is designed to recycle both the liquid and solid components of sewage into usable end-products.

The Solar AquaSystems process still utilizes sewage treatment plants: water hyacinths and duckweed. The process also utilizes sewage treatment animals--hardy snails, amphipods (water fleas), micro-invertebrates, and macrobrachium (large freshwater shrimp), plus several fish species in later stages of the system. All organisms play a specific role in the decomposition or consumption of organic matter.

The firm's sewage treatment method involves a series of flowing, covered ponds known as Solar AquaCells. The water in the cells becomes progressively more pure as the various organisms extract or devour contaminants. Temperature is kept warm and biological activity is maintained at a very high level. Specific features include air pillow insulated greenhouse covers and solar heat transfer system for temperature control, a constant 5.0 ppm level of dissolved oxygen to assure maximum bacterial action and inhibit growth of pathogens, plus periodic cropping of the rapidly growing hyacinths that would otherwise overcrowd the Solar AquaCells.

Activated bioweb substrates (sheets of plastic hanging throughout the aquacells to provide surface area on which bacteria and other microorganisms gather) aid the decomposition and natural food chain activity.

Ozone sterilization and sand percolation are used to remove bacteria and viruses from cells.

Harvested hyacinth biomass is not now used for compost, cattle feed or in a methane digester, but the potential for large-scale application is there. The hyacinth biomass produced each year will exceed one million pounds per acre. These incredible yields are obviously the overrriding factor in the process. They hold potential for both good--for biofuels, compost and fodder--and for ill--the fodder may contain the toxins taken from the water.

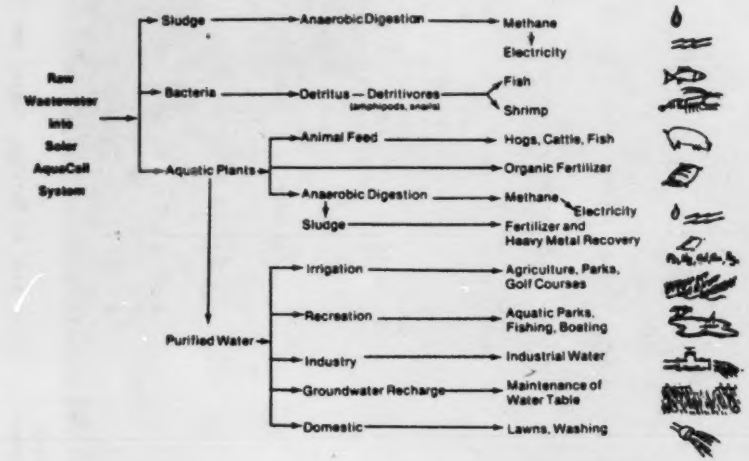
Water for agricultural, recreational or industrial uses is the system's end product.

ACTIVITY: Engage the class in a critical anaysis of the Flow Chart for the AquaSystems Process. If possible, secure input into the analysis from biologists, horticulturists, aquaculturists, sewage treatment personnel, and others who are interested in new sewage treatment procedures.

What aspects of the process, if any, would be readily accepted by people who live in your community? What aspects would probably be unacceptable? What elements of such a process would be mandatory for space colonies?

Flow Chart for Solar AquaSystems Process

CONVERSION OF WASTEWATER TO VALUABLE BY-PRODUCTS THROUGH AQUACULTURE



PURPOSE: To investigate which, if any, recycled materials are commonly used in normal construction.

LEVEL: Senior high school

SUBJECT: Industrial Arts
Science

CONCEPT: Social, economic, and technological changes alter the interrelationships, importance, and the need to recycle natural resources.

REFERENCE: Reynolds Metals Company, 6603 West Broad Street, Richmond, VA 23261.

ACTIVITY: Reynolds Metals Company designed and built a home to demonstrate that recycled materials can now be used advantageously in normal construction. The Recyled Home Fact Sheet and a drawing of the home are on the following pages. After sharing these with your class, pose a question as to how many recycled materials are normally used in construction. Conduct a survey of construction equipment and supply companies in your local area. Names of various companies can be obtained in the yellow pages. Include the difference in cost, if any, of recycled vs. new materials in your survey.

How many materials are reused from older homes and buildings that have been torn down (demolition projects)? What happens to the unused materials at demolition sites?

RECYCLED HOME FACT SHEET

PURPOSE:
To demonstrate that recycled materials can now be used advantageously in normal construction.

BUILDER:
Sam Kornblau, president of Realty Industries, Richmond, VA.

ARCHITECT:
Robert H. Clark, AIA, of Carlton, Taylor and Clark, Richmond, VA.

SPONSOR:
Reynolds Metals Company.

LOCATION:
10100 Cherrywood Drive at the intersection of Ednam Forest, Henrico County, VA (metropolitan Richmond).

CONSTRUCTION DATES:
Started February 1973; completed August 1973.

MARKET VALUE:
$60,750.

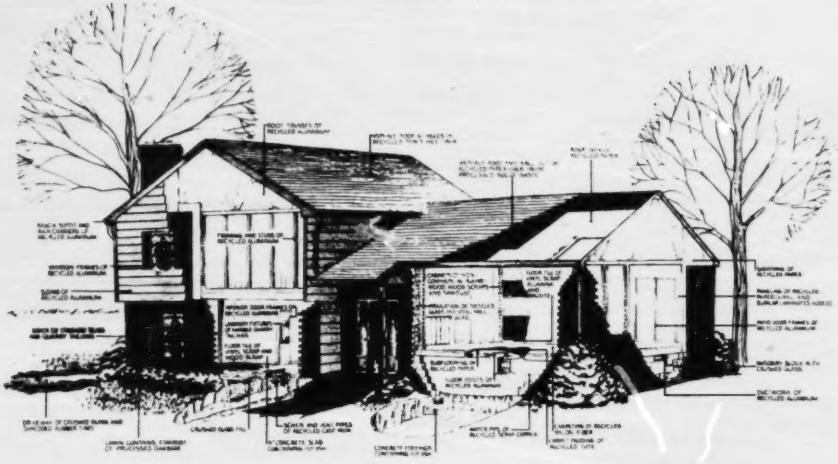
MATERIALS USED:
Aluminum scrap (equivalent to 183,500 12-ounce aluminum cans) in frames, joists, trusses, windows, soffit, fascia, rain-carrying equipment, patio doors and siding.

Crushed glass (enough to produce 124,000 average 12-ounce non-returnable beverage containers) for brick, concrete block and driveway pavement.

Recycled newspapers (about 8½ tons, the amount found in 100 tons of typical garbage) for sub-flooring, sheathing, paneling and roof deck.

Fly ash collected by air pollution control equipment at a coal burning electric plant (equivalent to 18 tons of coal needed to produce 41,000 kilowatt-hours of electricity) in concrete.

Marble quarry tailings for lavatories, tub and shower receptor . . . Recycled nylon fibers and recycled jute for carpeting and carpet padding . . . Steel mill furnace slag for insulation . . . Recycled paper and fibers for asphalt shingles . . . Wood scraps and sawdust for kitchen and bathroom cabinets . . . Recycled copper and scrap cast iron for piping . . . Recycled New York garbage for outside yard compost.



Reprinted with permission from
Reynolds Aluminum
Reynolds Metals Company
Richmond, Virginia 23261

PURPOSE: To operate a small aluminum recycling project.

LEVEL: Senior high school

SUBJECT: Fine Arts

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Durant, Raymond H. and James M. Mikuska. "A Practical Recycling Project." Science Activities, pp 14-15, February, 1973.

The article cited above describes a school situation wherein a central kitchen prepared school lunches for delivery to two elementary schools. The aluminum trays used to package the lunches were, after being used once, discarded as trash and became landfill material.

The industrial arts program in the senior high school of the school district provided opportunity for students to make sand castings of various useful and ornamental objects from aluminum that was purchased commercially in small ingot form.

A system was developed to collect from the elementary schools the used aluminum lunch trays and return them to the industrial arts laboratory. There the trays were melted in a small crucible furnace and cast into small ingots which proved to be as satisfactory as those previously purchased commercially. As the project developed, people in the community provided additional aluminum for recycling by contributing TV dinner containers, beverage cans, worn out lawn chairs and other items.

ACTIVITY: In a situation where aluminum casting is done in the industrial arts program, use the ideas suggested above to establish a similar program.

PURPOSE: To demonstrate some of the many uses of grasses.

LEVEL: Senior high school

SUBJECT: Fine Arts

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Dye, Dick. Earth Art. Project ECO-logy, ESEA Title III. Highline Public Schools, Seattle, WA 98166. ED 132 010

Discuss the fact that grass is a versatile and useful plant.

Pass around examples of grasses: bamboo, corn, sugar cane, rice, wheat, oats, wild grasses, etc. Continue the above discussion about grasses. Outcomes might be:

a. Grasses are world wide, they grow everywhere. *Where don't they grow?*

b. Grasses feed the world--rice, wheat, oats, etc. *What cereals do you eat?* List some trade names under headings "Made from grass," "Not made from grass."

c. Grasses as bamboo are used for construction in some parts of the world for fences, screens, even houses--some timber bamboo gets to be 40 to 60 feet tall and eight inches in diameter.

d. Grasses are used for root coverings, floor coverings, and wall coverings, as woven mats, thatching, etc.

e. Grasses are woven into useful objects as clothing, furniture, toys, etc.

f. Grasses are used as an art and craft form.

ACTIVITY: To weave grass you will need the following materials:

-Variety of grasses--include corn stalk, bamboo pole, stalk of sugar cane if possible
-White drawing paper 12 x 18 is best, several per student
-Watercolor pans and brushes, one per student
-India ink (black) and something to hold a small amount of the ink for 2 to 4 students (margarine tubs are excellent)
-Pen holders and #B-6 size pen, one per student
-Water pans, one per student
-One or two large utility sponges
-Several packages of natural color raffia
-Several cones of jute in many colors
-An assortment of colors in various weights of yarn
-A cone of string
-Several branches broken to 8-10 inch lengths, two per student (Madrona is ideal)
-Large plastic tub for soaking the raffia.

a. Begin by tying a branch to the back of a chair. See Figure 1.

Fig. 1. Tie the branch to the back of a chair before attaching the warp.

b. Tie on raffia, jute or string to the branch at every half inch or so. These will become the warp of the loom, or the part on which you weave. If you are using raffia, it is advisable to let it soak for an hour or so before tying it on, otherwise, it may break on you. The length of each string should be as long as you want the weaving to be, plus a few more inches you use up in tying it around the two branches. See Figure 2.

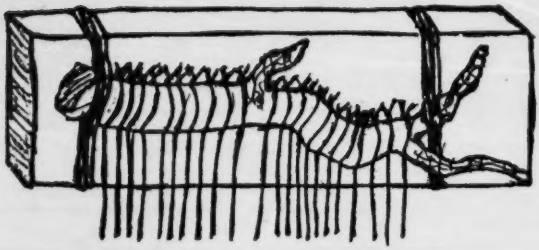


Fig. 2. Attach the warp to the branch every half inch

c. After all of the warp threads have been attached to the top branch, attach the bottom branch in the same manner. Try to get all of the warp threads the same tension.

d. With your collected materials, begin to weave your composition: over, under, over, under, etc. It is a good idea to weave a few times back and forth with yarn or jute after weaving in an object such as a heavy stick or piece of bark. Raffia can also be used for the weaving as well as for the warp threads. It will be easier if the weaving is begun at the bottom of the warp; however, it can be started at the top.

e. When weaving in dried grasses, let the ends stick out. Try putting in some other types of dried flowers or weeds. Notice how the flower heads stick out in Figure 3.

f. Try to keep from pulling in on the sides of your weaving, instead "lay the weave in." As you pull the thread through the warp, hold on to the other side so that your warp does not become misshapen.

g. After the weaving has progressed for as long as wanted, remove the loom and display the loom and weaving together as one composition or wall hanging. REMEMBER: DO NOT REMOVE THE BRANCHES FROM THE WEAVING, AS YOUR EFFORTS MAY JUST FALL APART.

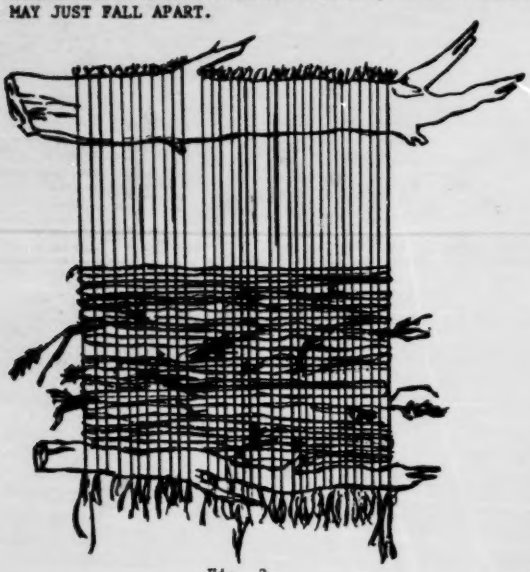


Fig. 3.

An alternative weaving loom could be made from heavy chip board.

a. Cut the chip board into pieces 9 x 19 (this will give you six looms from a large 38 x 27 sheet of chip board).

b. Along the 9-inch side tape two layers of masking or book-binding tape. Reinforce the corners also. See Figures 4 and 5.

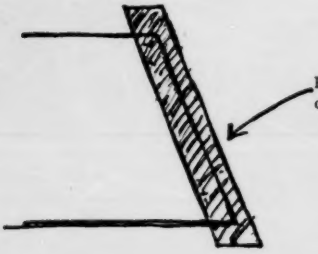


Fig. 4. Masking tape overlaps to the back side.

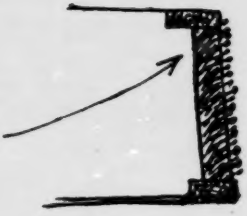


Fig. 5. Corners are reinforced with more masking tape. #3 pins are inserted along taped edge approx. every 1/2".

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c. Push #3 size straight pins in along the taped edge every half inch or closer.

d. Warp with heavy string, jute, or yarn. Bend the cardboard so that there is a bow in it before you begin to warp and then keep the bow by keeping the warp tight until it is finished and tied. See Figure 6.

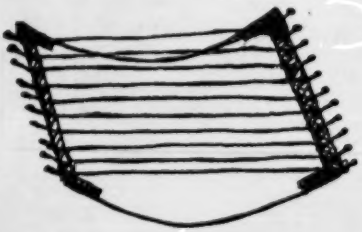


Fig. 6. The loom is kept in a bowed shape while the warp is being strung and tied. DO NOT GO BEHIND THE LOOM WITH THE WARP!

Display your hangings, weavings.

PURPOSE: To make rose petal beads to demonstrate that rose petals have an extended use including the ability to dissolve iron.

LEVEL: Senior high school

SUBJECT: Fine Arts
Science
Social Studies

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Schatz, Albert and Vivian Schatz. Teaching Science with Garbage. Emmaus, Pennsylvania: Rodale Press, Inc. 1971. ED 073 904

The story of rose petal beads begins with the Crusades or Holy Wars of the Middle Ages. These lasted 195 years, from 1096 to 1291 A.D. During this time, more than seven armies from Christian countries in Western Europe marched to the Holy Land. There they fought the Moslems and captured the places where Jesus was born and had lived.

One of the things the Crusaders brought back from the East was the knowledge of how to make perfume from roses. Some of them built a factory near a convent in Italy where they manufactured this perfume. Most likely, they produced what we now call oil of roses by distilling rose oil from rose petals. In any event, they ended up with a moist, pulpy residue which they discarded.

This material attracted the attention of nuns in the convent nearby, perhaps because it may still have contained some of the original rose scent. The nuns became interested in what it could be used for, and began to experiment with it. Among other things, they tried to make it into beads for their rosaries. They probably got the idea to do this because the name Rosary, which refers to prayer beads, was originally a metaphorical designation for a wreath or chaplet of spiritual roses.

They must have succeeded in this experiment because for several centuries rosary beads have been made from rose petals. One place where this is done is the monastery "Cartuja de Miraflores" near the city of Burgos in Spain. But the people who make these beads there will not tell anyone how they do it. They have always kept their process a secret.

However, about 50 years ago, many people in the United States used to make beads from rose petals.

ACTIVITY: You can do it now the way they did. First, you have to grind a large amount of rose petals in an ordinary kitchen meat grinder. It may be necessary to pass the petals through the grinder several times. You should catch the juice and work it back into the pulpy material that you finally produce.

This requires a large amount of rose petals because one ends up with a small amount of pulp. If you do not have enough petals to put through a meat grinder, you can cut up what is collected with scissors. Or, you can mash the petals like you mash potatoes until they turn into a soggy pulp.

This wet dough-like mass is then spread out in a thin layer and pressed down on the flat surface of an iron frying pan, or some other iron utensil. Every few hours or so the moist pulp is stirred, kneaded, or turned, and then pressed down again on the iron surface. After one, two, or three days, the material will turn black. This color results from chemical reactions between iron and certain compounds in the rose petals.

An iron utensil must be used as this supplies the iron for the chemical reactions. Grinding the petals breaks up the plant tissue which releases the compounds from the plant cells. These compounds are thus set free so they can react with the iron.

The coal-black dough that is formed does not resemble rose petals at all, but it does have the typical rose scent. Pinch off pieces of the pulp and work them into beads of whatever size and shape you like. Stick a pin, wire, or needle through them; and place in the open air and sunshine to dry. After two or three days, the beads will be hard enough to string on a thread. According to some reports, such beads retain their rose fragrance for years.

Some people have used petals from roses of different colors and from other flowers to see what kinds of beads they get and how they smell.

If you use the same iron frying pan over and over again to make rose petal beads, the chemical compounds in the rose petals will eventually cause pitting of the skillet. Strange as it may seem, many plant products dissolve iron.

PURPOSE: To actively involve a student group in conducting a recycling project.

LEVEL: Senior high school

SUBJECT: Language Arts

CONCEPT: Conservation policies are often the result of group action.

REFERENCE: A Supplementary Program for Environmental Education: Language Arts, Grade 11. Project I-C-E, Green Bay, Wisconsin, Title III, ESEA. ED 055 919

ACTIVITY: Introduce examples of possible recycling operations for your community (glass, paper, etc.). Give your class a week to collect current information about the specific cause chosen. As a group, share the collected information. Discuss possible advantages and disadvantages to recycling this product. Discuss the essentials of group planning and assign classroom committees responsible for:

1) writing factual handout sheets

2) writing newspaper articles.

Check sources for ideas which could be used to increase community impact. When the group has approved the publicity materials, distribute them throughout the community and initiate a drive. The signing of a pledge or petition could be used to create community support. Appropriate sites might include stores, village boards, theatres, etc. Evaluate your community's reaction by checking perceivable responses and noticeable changes or impact.

PURPOSE: To think of creative recovery and recycling projects in an effort to stimulate interest in recycling.

LEVEL: Senior high school

SUBJECT: Language Arts
Social Studies

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: The Recycler in America. National Association of Recycling Industries, Inc., 330 Madison Avenue, New York, NY 10017.

The following information is excerpted from a publication developed by the National Association of Recycling Industries, Inc. (see reference listed above).

THE RECYCLER IN AMERICA

"For many people recycling first emerged as an economic and environmental concept at the outset of the Seventies. Its values were immediately apparent in halting the depletion of the nation's scarce raw materials and energy resources, and as the most sound and intelligent approach to solving our burgeoning solid waste disposal and pollution problems.

"While it is true that a new awareness of recycling was rekindled at the beginning of this decade, it has been a vital part of America's economic life since its founding. And the nation's recyclers--from Paul Revere to the present--have made and continue to make important contributions to the country's economic and environmental welfare. Today, these processors, dealers and consumers of scrap metallics, paper stock, textiles and other industrial and municipal wastes are good citizens, community leaders, environmentalists and responsible businessmen. The impact of their operations transcends normal business interests. They are even more than an environmental necessity. In the words of a nationally-renowned consumer advocate, 'The good business of the recycler is our country's good morals.'"

WASTE NOT, WANT NOT

"The process of recycling--that is the conversion of scrap metal, paper stock, textiles and other waste elements into 'new' and valuable raw materials and products--was brought to these shores by the first settlers. Recycling was

inherent to economic life in the Colonial period when 'waste not, want not' was basic to the national philosophy. Scrap copper, iron and other metals were melted down and recast; old rags were widely collected for papermaking; wool garments and other materials were garnetted, respun and rewoven into

new apparel and other textile products. In fact, it was George Washington who projected a national commitment to what was later to be called recycling when, as President in 1793, he approved a requisition for a new chain for a frigate with the observation, 'Approved as far as regards a new chain, but is there an entire loss of the old one?'

"Actually, recycling is as old as mankind. In the Bible we read about the beating of swords into plough shares and spears into pruning hooks. The ancient Greeks, Etruscans and Egyptians made new products out of copper scrap. In China, the ancients remashed pulp-like mats over and over again which they used for writing paper. Chaucer, the father of English literature, earned extra money as a Clerk of the Works at the Tower of London, where, among other things, he compiled an elaborate inventory of scrap materials."

PAUL REVERE--RECYCLER

"James Smith and George Taylor, both signers of the Declaration of Independence, were metals recyclers. But undoubtedly American Revolutionary War figure Paul Revere is the most famous recycler in our early history. The hero of 'The Midnight Ride' was a noted silversmith and coppersmith. Like every metal worker of this day, he made extensive use of scrap. Silversmaking occupied much of his early life, but by the 1790's he had begun casting bronze church bells and brass cannon and copper fittings for ships.

In 1801 he established the first copper rolling mill in America in Canton, Mass. The contract to do the dome of the Massachusetts State House and the resheathing of the USS Constitution established him as the country's leading coppersmith."

RECYCLED LIBERTY BELL

"It is interesting to note, too, that the Liberty Bell, which rang out the Proclamation of Independence on July 4, 1776, is a product of recycling. It was originally cast in England in 1751 and recast in Philadelphia in 1752 and 1753. When it was first recast, the same basic ingredients were used; copper, tin, small amounts of zinc and silver. When it was recast for the second time, additional copper was added to the melt, to improve the color and non-brittle strength."

FROM GEORGE III TO BULLETS

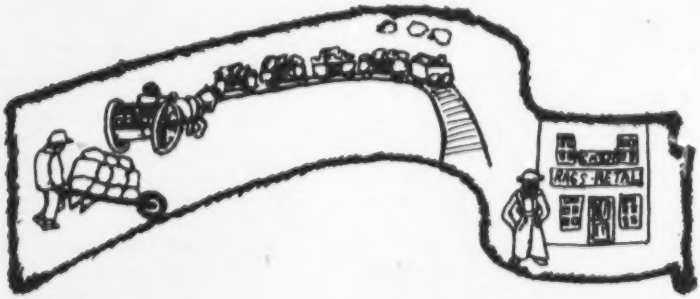
"Another little known facet of recycling history in America is the part a lead statue of Britain's King George III played in making badly-needed bullets for the guns of American revolutionaries. The statue, which stood in New York City's Bowling Green Park in 1776, was toppled by patriots, hacked into pieces, and shipped off to Litchfield, Connecticut. According to the records, at least half of the lead in the statue was melted down and cast into 42,088 bullets.

"The concept of reutilization in American economic life continued well into the 19th Century. The frugality of the early Americans was reinforced by certain realities: the limited availability at the time of virgin raw materials, and the need to develop national self-sufficiency in the face of overpowering foreign competition. Paul Revere's fledgling copper operation, for instance, suffered for many years from discriminatory tariffs which favored British and other European exporters. Up until the middle of the 19th Century, more than 60 percent of the nation's copper was imported. The balance was made up of scrap. Manufacturers made wide use of local scrap metal as well as the waste generated within their own industrial operations.

"A similar situation existed in paper. Rags, straw and paper stock were used in manufacturing finished paper products in 1854. Waste paper was used for making papier mache as early as the 15th Century, and it was used for making brown paper and pasteboard a century before the process of de-inking printed paper was developed by Matthias Koope in 1800."

PEDDLERS AND SCRAP DEALERS

"Intrinsic to the continuing cycle of scrap salvage and reutilization of waste materials in America's early history were the peddlers, famed in New England poem and story, who went from farm to farm bartering trade goods for used



and cast-off materials. Later, there were also dealers, jobbers and salespeople who handled scrap metals, paper stock and textile wastes. They sold the accumulations of these raw material assets to manufacturers who used them in the creation of 'new' products of every description."

CHANGES IN NATIONAL PHILOSOPHIES

"The Industrial Revolution, and the rapid conquest of the Frontier and subsequent emphasis on the development of the country's forestry and mineral resources, set in motion another wave of thinking in American life. By the third quarter of the 19th Century, 'waste not, want not' began to give way to the theory of 'limitless resources' and the 'throw away' concept which soon became imbued in national policies and public attitudes.

"But the recycler--the scrap dealer, the scrapyard owner and the industrial consumer of waste materials--has always been there, serving the needs of the nation. For many, it was a full-time and not always lucrative job. For others, it was a part-time occupation. In many smaller towns and communities, in fact, the recycler was the economic mainstay. It was considered the civic duty of waste paper dealers, for instance, to see to it that the mills in their communities were continually supplied with locally collected materials. For without this necessary raw material, the mills could not furnish new paper to sell and the community would soon suffer the economic consequences.

"Currently, many scientific and government authorities forsee the need for a 'Recycle Society' in a few decades--one in which we will be much more dependent on the continuous use of our recyclable materials. One way in which the public can help recycling meet the nation's raw material, energy and solid waste disposal urgencies is to help stimulate the increased recovery and recycling of metallics, paper stock, textiles and other potential raw materials."

ACTIVITY: Ask each of your students to think of a popular current product that might be potentially recycled, at least in part. Tell your class to pretend that in the year 2080, they have been asked to compile a historical booklet describing recycling efforts in America from the years 1970 to 2000. Assign each student to write an accounting of his/her chosen product, describing the "hows and whys" of the recycling project. The format utilized in The Recycler in America might serve as an example.

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RECYCLING RESOURCE INFORMATION

ORGANIZATIONS WITH INFORMATION ON RECYCLING/SOLID WASTES

Aluminum Association
750 3rd Avenue
New York, NY 10017

American Paper Institute, Inc.
260 Madison Ave.
New York, NY 10016

American Public Works Association
1313 East 60th Street
Chicago, IL 60637

Bureau of Solid Waste Management
U.S. Dept. of HEW
12720 Twinbrook Parkway
Rockville, MD 20852

Can Manufacturers Institute, Inc.
1625 Massachusetts Ave., N.W.
Washington, DC 20036

EPA
Waterside Mall
401 M Street, S.W.
Washington, DC 20460

Friends of the Earth
529 Dommercial Street
San Francisco, CA 94111

Glass Container Institute of America
4th and "O" Streets
P.O. Box 565
Antioch, CA 94509

Glass Container Manufacturer's Institute
1800 K Street, N.W.
Washington, DC 20036

Instructional Resource Center
National Training & Operational Technology Center
U.S. Environmental Protection Agency
Cincinnati, OH 45268

Izaak Walton League of America
1800 N. Kent Street, Suite 806
Arlington, VA 22209

Keep America Beautiful, Inc.
99 Park Avenue
New York, NY 10016

National Association of Container Distributors
603 S. 2nd Street
Irvington, NJ 07111

National Association of Secondary Materials Industries
330 Madison Avenue
New York, NY 10017

National Center for Resource Recovery
1211 Connecticut Ave., N.W.
Washington, DC 20230

National Solid Wastes Management Association
1120 Connecticut Avenue, N.W.
Washington, DC 20005

Rodale Press
33 East Minor Street
Emmaus, PA 18049

U.S. League of Women Voters
1730 M Street, N.W.
Washington, DC 20036

A Land Betrayed - Ugly America and What We Can Do About It

Alfred Higgins Production
9100 Sunset Blvd.
Los Angeles, CA 90069

Conservation - A Job For Young America

McGraw-Hill Text Films
1221 Avenue of the Americas
New York, NY 10020

It's Up to You

U.S. National Audiovisual Center
National Archives and Records Service
Washington, DC 20408

Litterbug

CCM Films Inc.
866 Third Avenue
New York, NY 10022

Municipal Sewage Treatment Process

U.S. National Audiovisual Center
National Archives and Records Service
Washington, DC 20408

The End of One

Learning Corporation of America
711 5th Avenue
New York, NY 10022

The Garbage Explosion ($220-purchase, $14-rental)

Encyclopedia Britannica Education Corporation
425 N. Michigan Avenue
Chicago, IL 60011

The Litter Monster

Alfred Higgins Productions
9100 Sunset Blvd.
Los Angeles, CA 90069

The Run Around

U.S. National Audiovisual Center
National Archives and Records Service
Washington, DC 20408

The San Diego Experience

Modern Talking Pictures Service
1212 Avenue of the Americas
New York, NY 10036

The Sanitary Landfill Up North

North Dakota State Health Department
Bismark, ND 58501

Things Worth Saving

Stuart Finly, Inc.
3428 Mansfield Rd.
Falls Church, VA 22041

Waste Material: A Natural Resource

National Association of Manufacturers
227 Park Avenue
New York, NY 10017

Wealth Out of Waste

National Distribution Center for
Bureau of Mines Motion Pictures
4800 Forbes Avenue
Pittsburgh, PA 15213

ENVIRONMENTAL EDUCATION PUBLICATIONS

Unless otherwise noted, these publications are available in both microfiche and hard (paper) copy from Educational Document Reproduction Service (EDRS), and may be located in ERIC microfiche collections. Most are also available in printed form from:

Information Reference Center for Science, Mathematics, and Environmental Education
1200 Chambers Road, 310
Columbus, Ohio 43212

Exceptions to the above availability statements are noted with individual references. Prices quoted are those of the Information Reference Center (IRC) as of April 1977, and are subject to change. EDRS prices are based on page counts, as indicated in current issues of Resources in Education.

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ED 091 172
John H. Wheatley and Herbert L. Coon, One Hundred Teaching Activities in Environmental Education. 1973; 204 pages. IRC price: $4.05.

ED 102 031
John H. Wheatley and Herbert L. Coon, Teaching Activities in Environmental Education, Volume II. 1974; 200 pages. IRC price: $4.65.

ED 125 868
John H. Wheatley and Herbert L. Coon, Teaching Activities in Environmental Education, Volume III. 1975; 195 pages. IRC price: $4.00.

ED 130 833
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